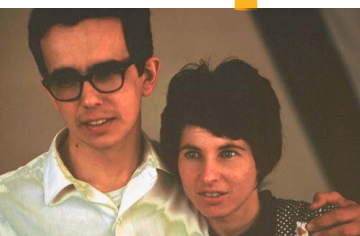


# Obrigado pela Vida!



Gracias a la Vida!  
Thank You for Life!



An 80+ Year Perspective  
By Joe Andrade



**Obrigado**  
**pela**  
Thank You  
for Life!  
**Vida!**

An 80+ Year Perspective

**By Joe Andrade**

*Obrigado Pela Vida!*

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This is a work of nonfiction. Names, characters, places, and incidents are a product of the author's memory and notes. Locales and public names are used. Resemblances to actual people, living or dead, or to businesses, companies, events, institutions, or locales are intentional.

*For Erma, Barbara, Tonio, and Aaron.*

*You made it possible, pleasant, productive,  
interesting, stimulating, and significant.*

Obrigado.

*I wanted to change the world. But I have found that the  
only thing one can be sure of changing is oneself.*

— Aldous Huxley, *Point Counter Point*

*Too much sanity may be madness — and maddest of all:  
to see life as it is, and not as it should be!*

— Miguel de Cervantes Saavedra, *Don Quixote*

*The world alters as we walk in it, so that the years of a man's life  
measure not some small growth or rearrangement or moderation  
of what he learned in childhood, but a great upheaval.*

— J Robert Oppenheimer

# Preface

**O**BRIGADO PELA VIDA – Thanks for a long, healthy, happy life. I've been lucky and fortunate to have been born and to grow up in a time and place where life was not overly difficult or traumatic.

Using words by Nicholas Kristof, I'm a winner in the lottery of life.

I've been privileged – statistically, entropically, randomly.

My 80th Year – and on into my Ninth Decade – is a time for reflection, for pause. It's an opportunity to search for, to find, to consider my experiences, education, and perspectives – and perhaps to impart some wisdom before departing from Life, from Humanity, from the Planet.

Thinking back to my own high school valedictory comments, will I be leaving this world any better than I found it?

A half century later I ask, will this world, this Planet, this Humanity even survive?

Like others in my age group, I think about Legacy. I am now an Elder. I should have some Wisdom to impart, some unique knowledge, some experience, some perspective. That's what Legacy is. Hoping mine may be relevant, useful, or even inspiring – it's available on line at [joeandrade.org](http://joeandrade.org). And it's available – in a simplified, narrative form – in this Memoir – also at [joeandrade.org](http://joeandrade.org).

*Should We Stay or Should We Go* is the title of a thought-provoking book, published 2021, by Lionel Shriver. She asks a range of critical, serious questions related to voluntary departure – voluntary death. She says:

The temptation is to hang on until it's too late, and the opportunity to exercise *agency* over the end of your life has passed.

Once one has reached the stage to depart, the agency with which to depart may no longer be available or accessible. I'll address my own voluntary departure at the end of this book.

## Obrigado Pela Vida

One's memories and thoughts may also begin to become inaccessible. I recall a book review by the New York Times' Dwight Garner – of a book written by someone with advancing Alzheimer's: "As a fog descends, the sentences still crackle."

I'd like my sentences to crackle – to at least be coherent and readable. I think they still are. But, clearly, the fog will eventually descend. I should 'publish' before my own fog descends.

This Memoir is a semi-chronological history of the major events, periods, people, and projects in my life. I think I've generally done 'good', been productive, been honest and rational, been helpful, been creative, perhaps even inspiring. But I've also read enough Mark Twain to understand that memories are fragile, thus unreliable, and that perceptions and perspectives are often less than accurate. We all have difficulty in being rigorously honest and objective.

This is my life. I've lived it largely 'my way', and I get to tell it in the fashion, order, and structure I think is best. *Obrigado...* is freely and readily available. Please distribute it widely.

*Obrigado pela Vida!*

Do the most good you can.

**Joe Andrade**

Salt Lake City / Pacific Grove / Mill Creek City

Sept. 1, 2023



# Acknowledgements

**T**HIS MEMOIR MENTIONS many people. There are many more, unnamed, that could have and perhaps should have been mentioned, noted, or otherwise included. Ditto for institutions, facilities, resources – and especially libraries. I thank you all – named and unnamed. Obrigado.

Thank You to:

Barbara,  
Aaron and Tonio,  
Amalia, Sylvia, Josie,  
Our Extended Family,  
Colleagues and coworkers,  
Students – Graduate and Undergraduate,  
and other Friends.

I even thank and acknowledge opponents and adversaries. They provided impetus, motivation, and stimulation for many of my actions, projects, and accomplishments. They helped stoke commitment, persistence, and – rarely – even anger.

# Dedication

First and foremost, and in the hope she will outlive me, Barbara, my ‘miracle’ wife and companion since 1962;

Our children, Aaron and Tonio; and

Our granddaughters: Josie, Sylvia, Amalia – who must shoulder the burden of a nation and Planet which modern Mankind has so arrogantly, ignorantly, selfishly, and willfully abused and desecrated. I am sorry that I was not more effective in altering and slowing that current planetary trajectory.

Good luck – do good, be strong, be resilient, be hopeful.

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# Pre-Puberty – Early Years – the 40s

*Beginnings • Azores, Grandparents, Family History •  
Decoto Elementary School • Early Jobs • From Thing to Puppy  
• Barnard Middle School • Puppy, Church, Hobbies, Work •  
On to High School...*

## Beginnings

I'VE BEEN LUCKY – via a kind, warm mother and an interesting, challenging father. Mom and Dad were married 8–4–1940 in Reno. They eloped. Conception must have been about October, 1940. I was 'legitimate'; I imagine Dad was pretty excited to learn Mom was pregnant.

He was certainly very proud and excited nearly 20 years later in Fall, 1959 when he called me out of a Chemistry class at Berkeley to say they have a surprise: Mom is pregnant with Manny!

"Bet you thought the old man had lost his spark!" he said.

Dad was 40 at the time, I was 20. Dad had also been a 'surprise', or at least a late, baby. His youngest sibling, Manuel, was 18 when he was born.

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I was born 7-13-1941 in a time when it wasn't too hard for them to make a living and raise a family. Erma (Mom) said it was raining when they took me home from Hayward Hospital to their little home in Decoto, California. They rented, then later bought, the house from Uncle Manuel, Dad's older brother, who moved in next door with their mother, Clara. I grew up speaking Portuguese (Azorean) with Grandma Clara and Uncle Manuel. Both houses had large back yards. Clara's yard included a large brown barn with many interesting corners and places to discover. There were chickens, trees, and work. Uncle Manuel hired me to do yard work and paid a regular weekly allowance – from the time I was about five years old.

Our neighbors, the Pagans, were a Phillipine-Puerto Rican couple with six kids just slightly older than me. Mrs. Pagan's mother lived a few blocks away – she was ancient, spoke little English, and didn't dress well. One day when I was about 4 or so, Mom and Mrs. Pagan were talking in our driveway – Mom in a hybrid Portuguese-Spanish, with Mrs. Pagan talking in some Spanish dialect. They communicated. I then noticed Mrs. Pagan spreading her legs. A few seconds later a thin stream of urine was flowing straight down! That was cool! No Thing needed to take out or aim. I tugged at Mom's sleeve; she shussed me and smiled. Later she explained what was going on. Why bother with underwear, I thought!

Dad could be volatile and tempermental, but he worked hard and was great with tools and repairs. He had high expectations. He worked at the Wedgewood factory in nearby Newark on home appliances, His job shifted to repairing pontoons on airplanes in the early years of WWII. He was drafted December 1944 when Mom was pregnant with Bob, my middle brother. Dad served in the us Army in Belgium, Germany, and France, returning in early 1946, when Bob was already 14 months old (born 1-13-1945).

Mom said Dad returned 'a different man'. He and his mother (my Grandma Clara) had strong tempers, but, Mom says, 'after the war, he was quiet a lot', had trouble sleeping, and would often get mad. Mom had to let it go, or he would take his anger out on Bob and me with regular slaps and mild beatings. It was hard for her. She worked and cautiously navigated her relationship with him, basically to protect Bob and me. I remember her saying, one time when we discussed her devout Catholicism, that Dad said there can't be a God – he saw too many ugly things during the war. A real God would never tolerate such atrocities.



Mom and I lived with her mother, Maryana, in Layton – near Fresno – for a short time while Dad was in Europe with the Army 1944–46. Grandma Maciel had a house on a large lot with a great garden. I would play in the garden. Grandma would give me newspaper comics which I colored and modified, making characters and stories stimulated by the comics. She said I'd play several different imaginary characters; she apparently enjoyed watching and listening. Those 'voices within' became very helpful in later years in school and adult life. Having the same full name as my father, I hated being called 'Junior'.

One time I stepped on a bee or wasp, got stung, and Grandma came to the rescue. She sat me down, rolled up my pants leg, went back to the house, quickly returned with a pan of her own urine, and put my stung foot in it. That was the standard folk remedy. It alleviated the pain and didn't bother me. Later I became very fond of the Placebo Effect. I was also fond of *biscoitos com cafe* (crackers with coffee). Caffeine did not seem to affect my abilities to sleep.

There was a swing in our back yard – or perhaps Uncle Manuel's back yard. It had a box seat. I started swinging early, perhaps 4 years old or so. Swinging stayed with me to this day.

Dad always found things to do, including expanding and remodeling the house. Bob and I helped as best we could, but often not quite good enough for his expectations. He taught us how to use tools, cut wood, drill, do projects, make things. One of my best birthdays, maybe 5 or 6 years old, Dad and Mom gave me a small toolbox with my own tools – and Uncle Manuel presented me with a lovely, sharp, and just my size, cross-cut hand saw – a half-size saw. I loved it – and the other tools – so much I cried. But in those days I could cry very easily – an emotional kid – hence the nickname 'baby Joey', which I hated to hear.

Once a month or so a tank truck would appear in Uncle Manuel's driveway, backed in very close to the chestnut tree. A guy would then fill two 50 gallon tanks, mounted horizontally among grape vines between the chestnut and loquat trees. Dad, or Manuel, and later even I, would fill 5 gallon cans with gas and top off the car tanks with this wholesale gasoline. It was their way of saving money and being more independent.

The chestnut tree was huge, shading both yards. Each chestnut was encased in a porcupine-like cage. We had to carefully pick them up to clear the paths

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under and around the tree. Although I think Mom and Grandma would roast them, I didn't like them and almost never ate one.

Dad sometimes didn't meet Mom's or my expectations. He would get home from work and begin to empty his pockets. There were nails, screws, nuts, washers, bolts, and related hardware – and even tools. All good for our home shop. I knew it was stealing, but we never asked. Otherwise, he was an honest, upright, reliable working man.

He was a natural with music. He could play the harmonica, even complex harmonicas. I think he learned to play when he was in the Army. One of his favorites was Sentimental Journey, learned I assume when he was overseas in WWII. He had a gift for music. Although they were married in Reno in 1940, Mom wanted a Church-recognized marriage. As Erma recalls, they were in our local church looking for the Padre and Dad started to play a Boogie-Woogie tune on the small organ, shifting instantly to Silent Night when the priest walked in – or so the story goes...

Church and Catholicism were important for Mom – and for me. I accompanied her to Church. In my younger years I became entranced with the concept of a Guardian Angel. Having an invisible 'angel' on my shoulder, always looking out for me, was just wonderful. I felt more secure, even more willing to take little risks because the angel was always there, scanning, helping, protecting.

We participated in study groups, using a thick paperback – *Faith of our Fathers*. That's where I finally learned that, although I'm 79 years old as I write this, I'm actually nearing the end of my 80th year! The lesson started with centuries, of course! I read much of the book with Mom, tutored a bit by our wonderful local Father Duggan. We also listened to Bishop Fulton J Sheen as he was all over the TV and radio in those years. I served as an altar boy for many years (never molested!) and even considered becoming a priest. In my younger years I enjoyed Sunday Mass. It was an hour or so of semi-quiet. It was easy to not think of work or school or other concerns. Restful, although not particularly informative or substantive.

I was quite taken with the Catholic concept of 'penance' – sort of suffering for Christ. I referred to penance many times in later decades – in a secular and metaphorical vein. I think it was also a ploy by Mom, and Uncle Manuel, to stimulate me to work in the yard. Dad didn't need ploys – he just gave orders. That was sufficient.

Brother Bob arrived when I was 3 ½ years old. I don't remember his early years, except for working (and fighting) together in the yard and helping Dad in the garage and carport. Our fights could get nasty. One time Bob approached me wielding a crowbar. We both easily survived. We had a friend almost next door, Joey Mateo. Joey was my age and we did lots of things together, sometimes teasing Bob.

When I was perhaps 5 or so, our neighbors, the Pagans, got a television (TV). It was small and had a circular screen. They invited Dad and Mom over to experience it. They watched a wrestling show, and ended up watching a midget tag team wrestling competition. Dad loved it. He was hooked. Ignoring Mom's mild protests he ran off and purchased a set. I recall lots of wrestling – and also Elvis. Elvis the pelvis, he was called, gyrating and moving across the screen. It must have been around 1950, shortly after Elvis started to become well known. He was fascinating to watch. Dad preferred wrestling.

I collected stamps. I loved learning of countries, maps, and geography. Uncle Bill Maciel, my Mom's youngest brother, gave me his stamp collection. I was elated, and continued collecting, off and on, for the next 10 or so years before shelving the large collection for good. I also collected pictures of airplanes and had them on the walls of my bedroom.

Uncle Bill lived in the Hayward-San Leandro area for sometime. His backyard bordered a field which bordered a drive-in theatre. Bob and I and our cousin Kathy would stand at the fence and watch a film while the adults talked inside. No sound but the image was fairly good. Free movies.

## **Azores, Grandparents, Family History**

Mom's family – Maciel – and Dad's family – Andrade – are both from the Azores Islands. Maryana Maciel (MM), Erma's mother, was the youngest of three sisters – from Norte Pequeno, a small village on St. George (Sao Jorge), the central island in the Azores archipelago. Her mother was Maria Azevedo,

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father Tony Borba. She was a twin, born March 9, 1897; her sibling was born dead. Her mother had gotten sick, but survived. Her mother didn't care for her, so at the age of 12 she left to Terceira Island to work. Her employer, a teacher, later died, so Maryana returned to St George, worked for her uncle (Manuel de Azevedo), making sharp cheese, and working as a maid in the village Colhieta. Her older sisters, Anna and Maria, emigrated to the USA. Her grandmother died when she was 17, in Norte Pequeno. Ignoring her mother's pleas to not leave, MM borrowed money and traveled to Boston by ship, then to Lemoore, CA by train – to be with her two sisters.

She soon met Gregorio Maciel – also from St. George, Azores. He had emigrated earlier, following his father. Gregorio became a legal resident. Maryana married him at 18, possibly after an arranged meeting and perhaps to insure her permanent immigrant status. He was seven years older. He was likely born in 1890. They had five children: Mary, John, Greg, Erma, and Bill. Grandma stayed with husband Gregorio for about 14 years. Although Gregorio did work their dairy cows and farm, he was often not at home; he was lazy, unreliable, and alcoholic. MM threw him out when Erma was about 8 years old. Maryana's two oldest boys were in their early teens and could apparently deal with the farm without their unreliable father. Maryana and Gregorio formerly divorced in Sept. 1944. She raised the five kids by herself. The children were very resourceful and helpful. Although MM wasn't really literate, she was very smart, strategic, and effective. Her kids were her literacy tickets – and good workers and helpers. Later she would buy fixer-uppers, which John, Greg, and Bill would fix up, and she'd then sell them for a profit. She even entered into oil exploration leases on some of her properties, but the leases were never developed.

Ex-husband Gregorio ended up in Monterey, working as a gardener on one of the Navy sites there, probably what is now the Naval Postgraduate School. I don't know how my Mom and Dad discovered Gregorio's location. Perhaps it was after Dad did his US Army basic training at Ford Ord, which is adjacent to Seaside and near Monterey. I recall family trips to Seaside to play in the sand and to visit Grandpa Gregorio when Bob and I were in elementary school. Dad had acquired an 8 mm movie camera and took some home movies of the visits. We knew where Grandpa lived in Seaside – 1173 Amador Ave. If he wasn't there, we routed to a bar a few blocks away – he was usually there. He was a real wino. Portuguese like to give wet, sloppy kisses. So Bob and I learned early what

a wino smelled like. Also smokers – I disliked getting kissed by my own Dad because of the cigarette smell. I never looked into Gregorio's background. We don't think he remarried or had any other family. He died in Seaside Nov. 5, 1965.

Dad's family also emigrated from the Azores – from Faial Island. His mother was Clara daLuiza Martins – born in 1882. She died March, 1961 in Decoto, CA. His father was Joe DeAvila De Andrade, born 1869. Their three oldest – Mary, Manuel, and Anne were born 1901–3 in Faial. My Dad, the youngest, was born much later (a surprise!) in Decoto.

Dad's father settled in the Decoto area in about 1912. Clara, Mary, Anne, and Manuel followed some three years later. They traveled on the Roma from Lisbon via Faial to Boston. The trip took two weeks. This was early in World War I; German submarines were following the ship. They then traveled for eight days via train to California and to Decoto where Dad's father was residing.

Dad was born Feb. 24, 1921 at Alameda County Hospital. His father, Joseph Avilla Andrade, was 51; his mother, Clara DeLuiz Martins Andrade, was 39. My father's father worked on the local railroad, examining and maintaining tracks. The small man-propelled track vehicle he was using was apparently hit by a train in 1926, killing him. My Dad was five years old. His mother, Clara, then had four kids to raise: Manuel, Mary, Anne, and Joe, the youngest. His older brother and two sisters were working and providing for the family.

In the late 40s and early 50s times were fairly good. This was the beginning of the American Dream period of U.S. prosperity. Dad was earning a good union wage, as was Uncle Manuel. Dad did like his 'toys'. My awareness of this began in 1949 or 1950 when Dad showed up with a bright, beautiful maroon red 1949 Ford sedan – in our driveway on 12th St., Decoto. It was brand new – beautiful! Bob and I climbed into the back seat and mentally vroomed around the neighborhood. That was the car we'd take to Monterey, as well as to visit relatives and friends in Hanford, Turlock, and Los Banos.

In Turlock we visited Mr. Manuel Duarte (known to us as Perguica) and Mona Pence, his housekeeper, common law wife. Perguica was my Dad's first cousin. He had a small farm, with cows and other livestock, even a horse. We were allowed in the barn. One time we were there during milking time. Perguica had me sit next to him, he continued milking, had me open wide, pointed a teat in my direction, and hit me with a stream of warm, sweet, white milk. Phenomenal!

Thanks to the stamp collection Uncle Bill gave to me, I began to learn some geography and history. I had stamps from the Azores and learned a bit about the islands, especially Faial.

## Decoto Elementary School – and Donny Delgado

We had no Kindergarten in the Decoto schools. On my first day of first grade, Mom walked me to Decoto school, a half mile or so up ‘H’ Street. The first grade teacher, Mrs. Fairbanks, knew Dad – she’d been his first grade teacher! And she remembered him as a bit hot-tempered. We were asked to put our names on the class blackboard. I very proudly wrote Joey Andrade in careful cursive, as Mom had taught me. Mrs. Fairbanks didn’t like that – she insisted on careful printing – cursive would come later. That was the first traumatic episode in my formal education. The cursive I could do, the printing not so well. I also had trouble distinguishing my right from my left, which added more to Mrs. Fairbanks’ annoyances. For many years I had to face in the same direction as my first grade class desk to tell left from right. A slow learner.

Speech was an elementary school subject. My diction was apparently not very good, so I was assigned a speech therapist. Perhaps it was my fluency in Portuguese slurring and pronunciation that compromised my English speech. All I remember is being taught to roll my tongue. Lots of rolling tongue exercises. I couldn’t do it at the beginning. But I still roll today! It did get me interested in speaking, reading out loud, narrating.

Skin rash was a problem – and hives. Mosquito or fly bites would swell up – not to the danger zone but very uncomfortable. So Mom wanted me ‘treated’ – Dad thought I’d grow out of it. He was largely correct. I recall the doc injecting fluid right under my rashy skin, forming an uncomfortable blister. The idea was to deliver some drug directly to the tissue under the rash. It must not have lasted long because I don’t remember anything else.

Donny Delgado was a little friend who lived two blocks away. Our mothers knew each other. Mrs. Delgado had a large garden. Her house was on my trek

to and from Decoto Elementary. The Delgado house included various sheds and workshops. Donny and I would meet and work there, building kites, model airplanes, and toy cars. There was a set of railroad tracks in between 11th and 12th Streets, between our two locations. Donny loved the trains and the tracks. Often we would cross the tracks when the train was coming, trying to beat it. One evening I was on my way home from Donny's place, in the dark, and heard the train. I thought I'd race to and across the tracks, just for fun. I knew I was a pretty fast runner. The closer I got, the crazier I felt. My heart had never thumped that hard or loud. I just barely made it, collapsing breathlessly at the side of the track as the train thundered by. Stupid.

Donny was somewhat social. One time he was to have a big birthday party. He wanted everybody to come. His bilingual but academically weak background resulted in the slogan 'Todo body come to my party'. He was called Todobody from then on.

We'd put little rocks on the tracks and then wait for the train to come. The trains didn't slow very much in going through little Decoto, unless it was a train changing cars in front of our local vegetable packing shed, where I later worked. So the trains would come, and the rocks would fly! Really cool! We were six or so years old then.

One day Donny outdid himself. He placed some larger rocks and a large water meter cover (essentially a concrete block) on the track and waited. I wasn't there that time. Later reports, and an explanation under the large photo on the back cover of an issue of *Life Magazine*, said the train actually pushed the block down the track until it hung up at a track changing switch. The front small guide wheels lost their footing, the train partially derailed, and tore up a long length of track. The investigation did get to Donny, who became the only local resident featured in *Life Magazine*. We were pretty proud! Idiots. There's now a Wikipedia entry for Marion Delgado, which must have been Donny's formal name. ([https://en.wikipedia.org/wiki/Marion\\_Delgado](https://en.wikipedia.org/wiki/Marion_Delgado))

The trains made a lot of noise – quite annoying at night if they stopped and were changing or picking up cars. We lived about 75 ft. from the rail line. We were used to rumbles and vibrations. And we also lived on or very near the Hayward Fault, part of the larger San Andreas fault system. My folks would occasionally talk about earthquakes. Dad would sometimes say, on a warm, muggy day: "feels like earthquake weather." I doubt that there was any

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connection or correlation. But I would find myself saying the same to my gullible friends.

One night, in bed, we experienced a large one. I was young, and recall it as like being in a boat on gentle, strong waves – just rocking back and forth. I didn't feel strong jolts. Later I learned that the San Andreas system faults are mainly lateral faults, rather than vertical ones, which influences the motion and the damage.

Uncle Manuel had this really cool sophisticated radio; it even had short wave bands. I loved to tune in to foreign short wave stations from Europe and elsewhere. This was a decade or more before transistors. The radio had an array of now-ancient glass radio tubes, including a magic eye-like tube which glowed green when the station was optimally tuned in. Tube radios were common. Tube tester machines were available in markets and hardware stores. You could test your suspect tubes, and purchase replacements if one of them tested bad.

School was fine. Mrs. Amaral, the second grade teacher, was great. Mrs. Smith in a split-schedule 3rd grade, needing something for me to do, taught me to alphabetize long lists of new words and phrases, which turned out to be very helpful in later years. I'd help the other kids with their work as needed, especially the tougher kids, called 'pachucos' at the time, who were largely Puerto Rican or Mexican. They actually looked after me, I guess because I would talk with and help them. I liked to play hopscotch with this cute first grader; the other kids would bully, call me 'wimp' or worse, and even threatened me (one or two of them were clearly jealous). But Jimmy Maldonado and Peter Aguilar were often looking on and looking out for me. It helps to have friends. Jimmy Maldonado, on the bus one time, opened his jacket and showed me what must have been an 8 inch blade with a big handle – his 'friend', he called it. Fortunately, we got along.

Fourth grade was interesting. Behind the teacher's desk at the far front of the room was a large jacket and coat closet with swinging doors. The teacher, Mr. Grillo, was very strict and quite mean. He was also quite short. We called him Mr. Gorilla. We all detested him. I had no problem with his lessons and tests, so he'd just let me read the class World Book Encyclopedia. Great!

When a kid acted up, he would order him into the big closet, tell us to keep working, then go in the closet and apply some corporal punishment, which we could all hear. Of course those 'bad boys' would encourage him, and let out howls of exaggerated pain, which we all heard – we would then cheer and clap. Mr. Grillo was not amused.



We had a way of getting even. We would take large-headed thumbtacks from the bulletin boards, place them inside our pants over the butt area, carefully arranged so the point was out but not penetrating the pants. We would waddle to the closet when told to, carefully assume the requisite bent over position. He came in to literally spank us hard on the butt. The first time or two he screamed as his palms were pierced by the hidden tacks. Even I played that game – once. He of course got wise to the game, but would often forget. He didn't seem to have the sense to feel our butts first before hitting. It was perhaps a macho thing. Anyway, it made a really dull class far more interesting. I think 4th Grade was the year we studied California history via a well-sanitized standard history text.

Dad obtained a private pilot's license under the GI Bill, studying and flying at the nearby Centerville Airport. I would go with him some times. Once he had his license he even took Mom and me flying – that was incredibly cool. He was part of a club with a small plane they called The Yellow Peril. I think 'peril' referred to their flying skills rather than the quality of the airplane. It was a small 2 seater, perhaps a Cessna or Piper. That experience did get me fascinated with aircraft and flying, and later parachuting. I wrote to the major aircraft makers for pictures, including some of the research planes. Chuck Yeager broke the sound barrier with the Bell X-1 in 1947, when I was about 6 years old. That was huge news. I was hooked. There were plane pictures all over my room.

When Bob was 2 to 3 years old, our next door Grandma Clara Andrade, who lived with Uncle Manuel, was probably disciplining him. She grabbed him and picked him up, then fell down, breaking her hip. She blamed Bob. She didn't heal and was then wheel chair constrained. Manuel and Erma cared for her and she was semi-functional. She'd make huge pots of rice pudding – lemon-flavored as there was a large lemon tree in the front yard, right at the corner of H and 12th Streets. She would stretch up slightly from her wheelchair to stir the pot on the stove. I'd sometimes climb on a chair to try to help out. It was really good – sweet, lemony – our favorite desert.

After a while she moved into our house so Mom would be always there to look after her. That was probably good for me, because we spoke Portuguese together. When I first went to school I was fully bilingual. I enjoyed entertaining her. One time when she had just finished urinating or doing #2, probably via a bedpan, aided by Mom, she looked content and relieved. And my little 6 year old face beamed: *Counsoula!*? – an explanation, an exclamation, and a question.

The Portuguese word meant to us ‘refreshed-thankful-contented-relieved’. It became a family joke and staple phrase.

## Early Jobs

Uncle Manuel, right next-door, gave me a weekly allowance for weeding, cleaning, and otherwise helping in the garden. I got weeding and gardening-like jobs, via neighbors and especially Bert Joseph, the owner-manager of our local market. He bought the market in 1949. Mom knew him. I started by cleaning weeds in the back, then aiding Jackie Navarro, in arranging and packing empty beverage bottles for return to the distributors. I cleaned windows, washed floors and walls, stocked shelves, and was a general little man ‘Friday’ for Bert and Jackie. I think Jackie was black – or at least very dark. He was the only black person I knew in town. He got tired of my many and constant questions. I was in my pre-teens at the time. One of the best pieces of advice I ever learned was from him:

“Never ask a question if you already know the answer.”

I also helped in the butcher shop – especially cleaning the big wooden cutting blocks. I would even serve customers, cutting lunch meat, etc. One time I cut the top of a finger knuckle while slicing baloney. Bled like crazy – never did find the little piece of me. I learned about ‘hamburger’ – it had everything in it – leftover lunch meet, leftover almost everything, sawdust ... Mom used hamburger a lot. I ate less of it.

Next to Bert’s Market was the local Post Office and then the Library. Mom knew Mary Janeiro, the post mistress, and she also knew the librarian (Florence?). Jackie Navarro had a room in Florence’s house, as I vaguely recall. I loved the library, of course, and went there whenever I could.

I recall a tiny barber shop on 10th St., on the way to Bert’s Market. I’d get my hair cut by the friendly barber there. As I liked to earn money, I also had a shoeshine kit (Dad taught me to shine – his – shoes very well). I’d set up outside the barber shop and talk customers into letting me shine – for a dime or so, I suppose. Later, Louis Pagan, our neighbor, did the hair cutting. He was a loud, personable, funny guy – right next door.

I acquired a set of coin vending machines – for peanuts and candies. They were heavy, so I guess Mom or Dad helped me to place and move them. Once in place I could service them twice weekly or so via bicycle. It was fun to empty the coins, count and package them, and take them to the local bank.

Comic books were a big deal for me. I was an avid reader and collector. Local markets sold them – most had a basket or box with used ones for a nickel each! I was especially fond of *Classics Illustrated*, *Super...* whatever, and anything involving airplanes. The *Blackhawk* series – four diverse fighter pilots saving the world – was very special. My very large collection disappeared after high school, though I don't recall disposing of it.

One science fiction comic story which has stayed with me to this day involved a large group of humans who went deep underground to avoid radiation toxicity – due to a nuclear exchange. They had built and programmed android-like robots to work the land, planting and tending crops, until the humans could safely return to the surface. Many years later, the lead human, first one out of the underground habitat, walked out into the sunny, productive landscape, and engaged the android farmer who greeted him. The human communicated his satisfaction with the productivity and quality of the growing and ripening vegetables, plucked a ripe tomato from its vine, and proceeded to consume it. The android – shocked by this cannibalistic and violent action – then killed the lead human, communicated to his android compatriots the problem, and they then proceeded to deal in a like manner with the all the humans emerging from the depths. I was impressed, siding with the androids!

This was a time at the height of the cold war and the nuclear arms race. Political paranoia was rampant – Communism potentially taking over the planet. Dad even talked about building a bomb shelter in the far back yard.

Mom and Dad were pleased that I wanted to work and earn money. I came up with several ways. One was to sell Christmas and greeting cards from a mail order firm. I would pedal many neighborhoods, going house to house, trying to sell. My bike had a storage box on the back and a basket on the front, where I could place and carry several dozen boxes of cards. These demos supplemented the catalogs my supplier provided. I even had my own business cards – typed using multiple carbons and then cut up to look serious. There was no risk or even fear of going in to strange and new neighborhoods.

## From *Thing* to Puppy

Part of my pre- to puberty education began with Donny Delgado. He was my Boy Scout tent partner – an old surplus WWII canvas pup tent. We had these hiking and camping activities in the local hills. That’s where I learned to walk bent over with a large backpack. Although I actually enjoyed it, the bad posture likely helped insure bad posture for the next 60 or so years, until back surgery at 76. Donny had an older brother, into cars and girls. So during one of our first scout camping trips, at night in the tent, Donny educated me on why our Things often became hard. I had no clue.

I knew I wasn’t circumcised, but I didn’t know why – and never asked. Since we only bathed once a week or so in my early elementary years, my ‘Thing’ would often get red and inflamed. I learned quickly that meant it needed washing. When I was very young, I had several accidents with my little Thing. I caught it a time or two with my zipper; that really hurt! The first time Mom was there and helped my unzip it. From then on I kept it clean and well put away before caging it. But aside from a little self-exploration, I was clueless – until Donny. He demonstrated how to activate the Thing. My first ejaculatory experience was a real revelation – it secured my serious interest! No need for details.

The neighborly Pagan girls, a few years older than me, would encourage me to display my Thing, behind the garage. Mom caught me doing that once. As the Pagan girls scattered, Mom told me if rigid too often my Thing would grow crooked and hurt as I grew older. I of course believed her. Decades later I realized that the Thing was just fine. It eventually changed its name to Puppy, and we have continued to entertain each other, quietly and privately, ever since!

## Barnard Middle School

For fifth grade we changed schools, and went up the hill to Whipple Road and Barnard Middle school for grades 5–7. It was adjacent to Alameda Creek (often dry) which meant some outdoor adventures.

Somewhere along the way I began learning trumpet, via a school class and instrument. Mom and Dad relegated my practicing to a shed attached to the garage, in our back yard. I enjoyed it but never was very good. Unlike Dad, I couldn't carry a tune and couldn't really hear in a musical way.

I met Homer in Mrs Wagner's 5th grade class. It was located at the end of a wing of five or so rooms which radiated from the center of the school into an adjacent field of wheat. When we misbehaved we were sent to the back of the building, outside the classroom and very close to the unfenced adjacent wheat field. That was fun. Homer was a tall, large, overweight kid, dark and probably Mexican. We sort of taunted and amused each other. We sat on opposite sides of the room and would launch wheat spikes (the ears or heads) at each other. A good throw would carry the head in a beautiful arc across the entire classroom, landing on or near Homer's head – or mine. We were of course disciplined for that. I was the one generally sent out. Fortunately the classroom had a row of high windows which were open during warm days. I could pick some wheat heads outside and go around the end of the classroom, launching the heads up and through the open window, where they would sail lazily into and across the classroom! Homer loved it. The whole class was readily disrupted. When those actions didn't work, Homer and I had a series of calls with which we could disrupt. I would say loudly 'Homer vale chili', sort of an ethnic phrase stating that Homer is worthless. It was harmless, albeit disrupting, fun. Ms. Wagner tolerated us without great dismay.

She distracted me via Richard Martinez, a kind quiet kid who needed attention and help. She 'assigned' him to me for some personal tutoring. We both enjoyed the interactions. He apparently had no one at home to help him, and he really appreciated the attention and help. And I really enjoyed 'teaching'.

Another positive activity was the *Barnard Daily News*. Barnard Middle was a new, modern school with a school-wide communications system. I was selected to read some announcements and news every school morning, as part of the principal's daily message. I probably selected and wrote much of what I read – don't recall in detail. The news interest and experience helped me land a job with the *Fremont News-Register* some years later, in 1957. I had a weekly local newsy social column.

The boys liked to play marbles. I often joined in. The highlight was when we could talk a girl or two into joining us. One in particular was already very

well endowed. She was a popular marbles partner. We had to crouch down and bend over to play successfully! – of course. Girls and puberty became very popular, almost obsessive, topics. I was growing up and well into puberty.

## Puppy, Church, Hobbies, Work

Self-entertainment via Thing (later called Puppy) required confessing – also my observational experiences and thoughts during marbles. I learned about the Rosary and multiple Hail Marys and Our Fathers (Catholic prayers). When about 10 years old or so I served as an altar boy for Our Lady of the Holy Rosary Church, one block behind our house. Father Duggan was kind and understanding. He was building a Parish Center about a half mile away, close to Barnard Middle School. He would say Mass in his work clothes, generally well hidden by his priestly black gown – except for the shoes. His unpolished, dirty, cement-crusted boots would stick out, causing great smiles and discussion among the altar boys and the parishoners.

One morning in 1952 the church burned, suffering major damage. I had served in the Mass that morning before school. After some questioning, it wasn't me! I did put out the candles. The cause was later established as an electrical issue. Fortunately, the Parish Center was nearly finished. So after some months Church reopened in the newly consecrated Parish Center, now re-named Our Lady of the Rosary Catholic Church – where we continued serving Mass.

It was in that new Church that I went through the Sacrament of Confirmation. I didn't really like the words 'soldier for Christ'. It wasn't much later that I drifted away from the Church.

Photography became a major interest and activity, starting with a literal cardboard box camera. After shooting all the frames, I'd open a tiny slot in the box, insert a \$1 bill – maybe two – and literally mail the camera to the company. A few weeks later, I'd get the photos and negatives – and another preloaded camera! It worked well for me and launched my strong interest in photography.

I ‘inherited’ a folding camera from Dad, or a relative, and did my own black and white film processing and printing. About 1956 or so Dad let me transform our old, discarded outhouse (which I don’t recall having to use, as we had an indoor toilet when I was already very young).

The waste hole underneath had long since been covered and sealed. The decommissioned outhouse became Joey’s Darkroom; it was just the right size for a small sink for washing film and prints. A working table was built over the seats at stand-up height. It was a place to do semi-serious photography, as well as to hide. I obtained and used a 35 mm single lens reflex (SLR) during high school and beyond. I often used Tri-X film pushed to ASA 1000 or more and took ambient light action shots of high school sport events. I even did some wedding photos – I think for Gloria Pagan.

The 35 mm came in part due to a ‘polio’ scare. Although I had earned the money for a quality SLR 35 mm camera, Dad had felt it unnecessary. But about that time I developed symptoms, especially a very stiff neck, perhaps attributable to polio. I was diagnosed as a ‘possible polio’ and hospitalized, placed in quarantine, talking with people only via a telephone. During the hospitalization and testing, Dad agreed to let me get the camera when I was discharged. Fortunately, I didn’t have polio – and I did acquire a terrific 35 mm camera!

The outhouse darkroom was of course a very private place. Several times Bob, Joey Mateo, and I had ‘meetings’ in it in order to explore and demonstrate our Things. I was the oldest, so my Thing was the more developed and impatient. We had several contests – we would time how long it would take from retrieval of our Thing to its ejaculation. I would always win, with a time of 20 seconds or so. My Thing would almost ejaculate via thought processes alone. Wet dreams were common in those days.

One summer I sold Cutco Cutlery door to door. I was part of a small group under a large overweight ‘handler’ who drove a massive Lincoln Continental. His boss was what a pimp might have been – fast talking, confident, also full of stories. He showed us the condoms in his wallet, talked about girls. We were fascinated adolescents. We’d be driven to a large tacky subdivision, assigned to different areas, and go door to door selling marvelous cutlery, showing the *Cutco Cookbook*, a box of knives, take orders, etc. I was never any good at selling.

But working enabled a sense of real independence. I could work, I could earn money. Independence also came with age, growth, and self-confidence. I

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worked with Mom at the Dutra's orchard and farm. Dad's sister Anne had married Joe Dutra. They had an apricot orchard on Thornton Avenue, more or less at the border between today's towns of Fremont and Newark. They were 'well to do'. We would slice apricots and set them on large 3 x 6 ft trays for solar drying. Mom and I were pretty fast, helped the Dextras, and I made some money. I also helped a Mr. Perry, right off Decoto Road, not far from our home, 'pick' and collect cherries or apricots. On bad years he would go around with a pole knocking apricots down from the trees (not enough on the trees to hire pickers), and I would run around retrieving them from the ground. He was already ancient, like 70 or so, but he never got tired. I did.

Decoto, together with nearby Alvarado, combined to become Union City in 1959.

Mom's middle brother, Greg, and wife Polly owned a lot and cottage in Bethel Island, near the Sacramento River. Greg was the levee custodian for the island. He worked hard clearing brush and generally keeping the levee intact and safe. We would sometimes help. It was during a trip to be with Greg and Polly, driving through miles of orchards and farmland, that I realized I could be – indeed already was – financially independent. I could work, earn money, buy my own food and stuff – even raise food if needed.

My father was often a rough, angry man. He had high expectations, and occasionally dealt out corporal punishments on me and brother Bob. Mom tried to protect us without further aggravating him. I recall one time when I was perhaps early teens, on the back porch of our home, Dad was in a vile mood. He was about to hit me. I put my hands and arms over my face, stood there and faced him, and knew I could take whatever he might dish out. I felt almost invincible. He was furious. It was then I knew I was nearly a man and need not fear him anymore – and he knew it, too.

A year or so later he had to change jobs. His new position, as a handyman/janitor with the Union City School District, required a physical exam. He said that as he entered the physician's office, the doc looked at him from across the room, studied his face and neck and said

"You have hyperthyroid."

He was tested, he indeed did. He went in for surgery, which was much longer than expected. His thyroid was apparently so enlarged that it was difficult to find it all. He was a much more tolerable person after the surgery.



# High School to Berkeley – the 50s

*High School • Jobs • Home and Cars • To Berkeley •  
Hello to Barb, Bye to Berkeley • A Miracle Begins...*

## High School

I ENTERED WASHINGTON UNION High School (WUHS) in nearby Centerville (later Fremont), in fall, 1955. I was a non-athlete mediocre trumpet player with good academic grades, interested in journalism, music, and science. I joined the marching band, took journalism and English, and was elected Sophomore Class President. I did ‘campaign’ – by hiring a classmate to wear a Vote for Joe wearable sandwich sign – front and back. We walked around together for the few days before the election. I joined the student newspaper (*The Hatchet*) staff and became somewhat known on campus. The Huskies elected me Student Body President for the senior year, but I don’t remember the campaign.

Marching with a trumpet perched on my lips for a year resulted in some loosening of my front teeth, so I didn’t continue with band – or with trumpet – after freshman year. We did have a great band leader. We did a half-time program one football evening where we marched and made various formations

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with a tiny light on each of our instruments. The stadium lights were doused so our individual lights were visible. And we played – especially the trumpets – Stardust – swaying gently to the music, the movements easily visible from the stands. The spectators loved it. Beautiful, magical.

High school was educational and expanding, thanks to Igor Skaredoff, Ken Brown, and others interested in writing, reading, culture, and talking. Igor and I would run and dribble our imaginary basketball in the halls. I was intrigued by his parents – Russian immigrants. His mom tried to teach me a bit of Russian. Igor was already a great fan of classical music. The only music I knew were a few Portuguese humorous folk songs. Later I studied Russian at Berkeley.

Freshman English introduced me to writing – including a really good short story (lost to posterity) about Boy Scouts in the hills trying to sabotage Russians who were invading our area. This was the early years of the Cold War and the nation's obsession with anti-Communism.

Sophomore English was the year of Sputnik and Laika, the poor first dog in space. I composed a poem for Laika (lost to posterity) which the young English teacher liked. He was the one who cautioned, the first day of class:

“There's only one excuse for missing an assignment: a death in the family... Yours!”

I believed him.

I also took Journalism from Mr. Collins, the faculty advisor for *The Hatchet*. I wrote stories for the paper and became its editor during my junior year.

Igor, Ken Brown, and I enjoyed trying to write creatively. We participated in the WUHS literary magazine, *The Inkling*, in 1958–9. My ‘intellectual’ friends included Robie Kelly, Cathy Swoda,

Jerry Greene, Ron Roe. I lost contact with all except Igor after high school. I caught up with them much later in 2009, at the WUHS Class of 1959 50th reunion, except for Ken Brown. I tried hard to reach him but was unsuccessful. He was the best writer and philosopher of the group. He even self-published his own collection, *The Cynic* (with Victor Harlow), in 1955. The copy I purchased from him for 20 cents is accessible at [joeandrade.org](http://joeandrade.org).

Serving as Editor of *The Hatchet*, I worked closely with Mr. Collins. He was a great mentor and supporter. He gave me his spare copy of *Writer's Guide and Index to English*, 1950, which I still have. It is shelved prominently next to Strunk and White's *The Elements of Style*, published the year I graduated high

school, 1959. I wrote papers on airplanes, stamp collecting, and history, including a large one on FDR: The Renaissance of the American People; it was quite comprehensive. Some are at [joeandrade.org](http://joeandrade.org). I came very close to majoring in journalism in college.

Sputnik helped inspire me to study science, especially chemistry and physics. My Chemistry teacher, Mr. Armstrong, was terrific, including his class explosion and my science fair project, dealing with gamma radiation and magnets. Physics as a subject was great, but not the teacher, although he did encourage me to apply to UC-Berkeley.

During the 1957–58 school year the western-most Cape of Faial in the Azores came to life as the Capelinhos Volcano, erupting sporadically during much of the year. That was big news among the Portuguese community, and sparked my interest in learning more about the Azores and Portugal.

In mid-high school I participated in Junior Statesmen, a club or chapter connected with a national and regional competition called Boys' State (there was also a Girls' State). The group fostered interest in current events, politics, history, and civics. I represented WUHS at an annual conference, a model United Nations. It introduced me to smart, high performing high school students! I forget what nation I was supposed to represent – Portugal, perhaps? I do recall early in the conference an emergency announcement to all delegates that the Gulf of Aqaba had just been blockaded. An emergency session of the 'Security Council' was called immediately. I wasn't representing any nation on the Council, but I did do some rapid homework, mainly via Q and A and discussions (no Internet or Google back then). I started learning political geography, world history, and international politics. Fascinating. My earlier stamp collecting activities did provide some foundation for interests in geography and politics.

There was also an election during the meeting, perhaps for Secretary-General of the UN. So in a huge General Assembly I heard the candidates speak. A candidate named Ure, as I vaguely recall, gave an incredible speech. Strong, clear, factual, informative, with discrete and strategic pauses. Very impressive. I voted for him. It was a great introduction to public speaking, convincing people, and expressing leadership qualities. It was also an experience that enhanced my interests in nations, geography, and international issues.

## Jobs

One of my first regular jobs, in addition to Bert's Market, was cleaning a medical clinic in the evening. It was at the top of H Street, near Decoto Road. Decoto's only real monument was nearby – honoring the men lost in WWII. I would empty trash, sweep, vacuum – general cleaning. The clinic was a large home with a yard, which I kept up, weeding and trimming, perhaps mowing. I was alone there in the evening, so it was very private. One of my first semi-serious female interests, Faye, joined me there for several innocent evenings. We did do some mutual exploring, but nothing dramatic.

My main job starting in 1957 was nearly next door to our house – Don Alvarado Co., a carrot packing shed managed by Al Solari, a loud, jolly, friendly Italian fellow. His building bordered the railroad tracks just across the street from our front yard. I assembled cardboard boxes, served as a maintenance man assistant, did cleaning, etc. Al taught me a lesson or two. One time we had to move some large object. He asked me to retrieve the firm's 'sky-hook' – a large hook-like device, probably stored on top of one of the storage rooms. I looked and looked and found nothing resembling a sky-hook and reported back. He asked me how big it was, how it looked, its weight. I said I didn't know.

"Then how can you find it?" he laughed. "You dumbass," he continued, laughing even more – together with several coworkers.

A good lesson which serves me well, especially now as I look for things I know are there but can no longer easily recognize.

In the evenings I worked as an aid to Al's retired maintenance man, Mr. Janeiro, I think. He lived a few blocks away and did building and repair jobs in the packing shed – often involving steel cutting and welding. I found that fascinating – perhaps leading to my later interests in metallurgy. I would place and hold pieces while he welded them. I had slag scars for decades after – one is still visible.

My major after school job with Solari was making boxes, using a large stand up stapling machine. The boxes came in large flat packs of some 50 or so. I had to fold and form each box, and then staple the bottoms and sides with large copper or brass staples, then put the assembled boxes in huge stacks and rows for the next morning packing crew. The production line washed carrots, placed

them in plastic bags, tied, and placed them in my boxes, then off to a pellet for later delivery via truck or the adjacent railroad. The carrots were helpful in an important courtship several years later.

The production line was maintained by a little, quiet man who was always running around doing little things. He would remove and replace bags of discarded carrots, replace the piles of plastic bags, replace the stock of my assembled boxes, haul the filled boxes away, etc. etc. It was only later I fully realized how vital the little guy was – without him the production line would have shut down in minutes.

The jobs were great life experience and good money, most of which went into my growing savings for college. I worked all through middle school (Barnard) and high school.

## Home and Cars

I started driving in mid-high school. I only remember Mom's big brother, Uncle John, riding with me and critiquing that I was taking turns a bit too swiftly. I also remember many issues with getting the hang of clutch, brake, and accelerator synchronization. Mom had a Henry J for a short time, which I drove a little. It apparently came via Dad's cousin, Mr. Perguica, who died in 1956.

Somehow, I acquired a 1936 Chevy – a sedan that worked well. Don't recall the source, the cost, or the reasons. Another driving fact was Dad's Jeep. These 'second' cars were usually parked parallel to 12th Street, at the front of the house. We had a small wooden white picket fence separating the front yard from the road. I would move the Jeep when needed to make room for the Henry J and later for my '36 Chevy.

One afternoon after school I had to move the Jeep. It had a heavy steel bumper which extended a bit out from the sides. I found the clutch-accelerator functions of the Jeep difficult. As it lurched forward there was a crack, crack, crack as the bumper caught the fence pickets and ripped through some ten or so of them. Shit! Dad would be furious! He could get very mad and mean in an instant. And this time he had a good reason. So I hurried inside and got to work. I

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found some appropriate lumber and began sawing replacement pickets. It took all afternoon. I installed them and was painting them when Dad got home. I was very afraid to tell him what happened. He saw the busted lumber and the pickets I was painting, and my frightened, hesitant look – and burst out laughing. The whole incident became a Joey joke, which he never forgot to tell.

# To Berkeley

Berkeley admitted me. My savings and several small scholarships, including one from the local chapter of the Cabrillo Civic Club – a Portuguese cultural organization – made it possible for me to live in Berkeley. After graduating high school, and presenting a graduation speech along the lines of *Leaving the World Better than I Found It*, I entered UC-Berkeley in the Fall of 1959, determined to be a Physics major, although Journalism continued to be a major interest.

I lived at Barrington Hall, a large coop men's dormitory on Dwight Ave. I quickly joined the building maintenance crew. That was fortunate, as I immediately had some like-minded semi-skilled friends and access to tools and materials with which to improve my own room (shared). There was a construction project next door – across Haste St – with all the plywood panels and 2 x 4 pieces of lumber any 'good' maintenance man might want – via nighttime acquisition. We had supplies for bookshelves, desks, benches readily available.

Barrington became a focus for organizing protests against the notorious House Unamerican Activities Committee (HUAC) during the McCarthy era, before the Berkeley Free Speech Movement. I had no clue as a beginning freshman as to all the commotion and discussions. But I learned.

My minimal participation in Barrington's outside activities was to help produce and erect a Beat Stanford banner on the top surface of the Treasure Island Tunnel that fans encountered on their way to Berkeley for the Stanford – Cal game in Jan. 1961. That was scary – climbing out on a concrete barrier some 75 or so feet above four lanes of impatient traffic. We made the papers.

Barrington and Berkeley was my first experience with roommates. I was assigned to a 5 person 'room' with 2 large bedrooms and a private room at the back

of the suite, accessible by walking through one of the bedrooms. The prized private room had a sink and other amenities. I recall entering the suite, shared bathroom on the right, and walking into the left bedroom, which I shared for a time with Tom Hogan, from Redwood City. The private room in the back was blaring Elvis Presley from a high quality reel-to-reel tape deck, but the words were unintelligible. I introduced myself to the short, portly occupant who explained that ‘Elvis’ was singing in Farsi. Our roommate with the private room was from Tehran, Iran. It was my first Berkeley international experience. I don’t remember his name, so let’s call him Ahmad. Ahmad knew the ropes of Barrington Hall, the apartment house next door, and the technique of talking to young coeds via glasses of something called Sloe Gin. What an education! I’d never even had gin, let alone exotic versions.

I also roomed with Darrell Holmgren(?) later that first year. Darrell was a very serious, tall, thin blond kid from Chula Vista, south of San Diego. Tom Hogan spent Year 2 at College of San Mateo (CSM). We stayed in touch. Tom could be somewhat philosophical. I remember him saying something like:

“I’m going to change careers every 20 years. It’d be boring to be doing the same thing for longer than that.”

So he eventually became an accountant and later a CFO! But I thought of the idea as advice, and considered it over the next several decades.

Howie, a math guy, and Kent Stitzer, a biology-physiology type, were in the other bedroom – Howie from southern California and Kent from Michigan. Howie had a buddy studying at UC- Davis who would ride the freights from Davis to Berkeley-Oakland for visits. Howie was always quoting his rail-riding friend. The pearl I remember – a great piece of philosophical and practical advice:

“Don’t sweat the cheap shit”.

I’ve been quoting that and not sweating little things ever since.

Columbia Record Club made an offer I couldn’t refuse, so monthly records – LPs – began to appear in the post. I must have had a cheap record player, even at Berkeley. One of my records was an Amalia Rodrigues greatest hits album. I learned of her via my parents and Uncle Manuel, who were Amalia fans; they attended a live concert by her in San Jose when I was in elementary school. Their interest in her sparked a life-long interest in Portuguese music, especially

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Fado and Amalia. I also subscribed to the weekly onionskin, airmailed version of the *Manchester Guardian*, continuing to be interested in current events and international issues and perspectives.

One of my maintenance crew mates was Paul Duncan. We were taking the first physics course together. The class required much homework – weekly problem sets that were all very difficult for me – and also challenging for Paul. I can recall, visiting his room at Barrington, asking why there was a hole in the plaster wall under his desk. He looked at it, then at me, then uttered a string of profanity about ‘those physics problem sets’:

“I get so frustrated I have to kick the wall!” he yelled, adding, “Someday someone’s going to pay for this.”

And they did; he became a cancer doctor.

His roommate, Bob Holmstrom, also on the maintenance crew, became ‘famous’ for his instructions to the crew’s workers:

“Paint everything... If it moves, nail it down, then paint it.”

It was a good lesson. Fresh paint revitalizes, and covers over many mistakes.

Paul and Bob were already friends – from Denver. They were now part of the UC-Berkeley ski team, as I recall. What made this interesting to me was they had to go to Reno for a regional ski meet or event. I was later told that they and perhaps other team members, all male as I recall, took a side trip east of Reno to a local brothel. They said it was time to learn some anatomy and physiology and satisfy their late adolescence yearnings. That was cool. Puppy was jealous.

I did OK on the first physics midterm exam, due to a perfect score on a question on the Bernoulli Effect – that was thanks to my interests in aviation and flying. But physics and I parted ways from then on.

I recall one early physics lecture where the prof said:

“Many of you will fail, most of you will never become physicists. This class is really for the few of you with the brains to go all the way.”

Ouch.

That first year I obtained a job washing Petri dishes in a bio-virus lab almost adjacent to Cal’s famous Campanile Tower. I enrolled in Russian 1A that first year, as well as Physics, Speech, Math-Calculus, Anthropology (because the registration line was moving...), and Air Science (ROTC – to help protect me from going to Vietnam), as well as the required physical education course.



Several times a year there were events to facilitate meeting women students from Berkeley and nearby colleges. Somehow I met a Ruthie from southern California. She had a birthday on June 14, Flag Day. We were a bit infatuated with each other for several months.

The next year I ‘inherited’ the private room and began modifying it for my ‘needs’. We all pitched in to tear down a wall between my little ‘private’ space and a large adjoining walk in closet. The room had a large window looking out on a driveway and onto the apartment next door, where those coeds fond of sloe gin were housed.

I had a hard time with Russian so experimented with subliminal-like night-time learning. On the large empty wall of my private space, I installed a huge tape loop, so I could listen to a recirculating language tape all night long on my used low quality tape deck. The audio tape wall had a great Rube Goldberg look to it, and actually worked. It was fun to see the tape slowly moving from spool to spool nailed to the wall! I’d sleep with a set of headphones on (a half century before AirPods and repeating, easy to use audio devices). The system worked, but it didn’t help me learn Russian – and cost me needed sleep.

Early in that first term I began to develop headaches. I knew I was working and studying very hard, but I also realized that I’d been having a little trouble seeing blackboard text, especially in Russian class. The Student Health Service concluded I needed glasses – that my vision had deteriorated somewhat. First they recommended me to the campus School of Optometry, located up the hill just above the Chemistry Building. They assessed my vision, concluded, I think, that my eyeballs were a bit distorted, and that my vision might be correctable via eye muscle exercises. That sounded reasonable – and preferable to glasses. For several months I’d participate in eye exercise activities, rolling and turning my eyes in front of small tabletop light boxes. After several months, my impatience took over, and I was fitted with glasses. The new glasses worked. The headaches went away. I have worn corrective glasses ever since.

That first year I would go home on weekends, using a newly purchased used motor scooter and via riding through Oakland and Hayward to Union City. I continued to work at the packing shed on weekends. On one of those late Friday trips home, somewhere in Oakland, I passed a car on the right as the driver was waiting to make a left turn. A large pedestrian loomed, I swerved but hit him as I fell off the scooter. He fell as well. It was mentally traumatic for both of

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us. He assured me he was ok. We exchanged names and contact information. I don't think I was cited or any police were called in. The scooter and I were ok, so I continued home, slowly – and shaking. Dad was furious, of course. He was very afraid we would be sued and that he and Mom would lose the house and all their possessions. I was afraid, too – but, luckily, the man never contacted us. I did learn a major lesson about impatience and safety. I could hear Uncle John's criticism in the background. I continued to ride the scooter, but made plans to acquire a real car.

Year two at Berkeley was quite eventful. I began Chemistry, continued with Physics and Russian, decided I really wasn't physicist material or a Slavic linguist, changed majors to Math, and got a a job in the main library. I stopped working at the packing shed and going home every weekend. Every Friday I'd go to an on campus temporary work office and find job notices for weekend jobs – gardening, brush removal, painting, woodworking as a helper, etc. The residents in the Berkeley and Oakland hills were affluent and paid well. I also did some tutoring of individual high school students in math and science. I really enjoyed tutoring.

Year three was even more eventful. Tom was back for the first semester, although we were not roommates; he then dropped out the next semester, and attended SF State before ending up at San Jose State College. I got a job in the main campus library, eventually working in the very hectic and busy Reserve Book Room (RBR). It changed my life!

In late 1960 I was in a Chemistry lab and was somehow pulled out for a phone call. It was Mom. Uh oh. In response to my anxious concern, she said all was well but that Dad needed to talk with me. More uh oh. I thought it was about the earlier scooter accident. Dad came on, had a cheerful voice, and said something like:

“Your Mom's pregnant!”

I, of course, expressed great surprise – and some relief – and blurted some sort of congratulatory phrase for my soon-to-be – 19 years younger than me – little sibling.

“Bet you thought your old man had lost his spark!” he enthused.

We laughed and then Mom and I continued talking for a few more minutes. Yes, Manny was a surprise, but they seemed to be pleased and happy. Manny was born August 3, 1961.

The library ‘housed’ people just interested in books, learning, reading, understanding. And not just the library. On the grounds, in cafes and coffee shops, in the used bookstores on Telegraph and Bancroft – all over the area – individuals and small groups just seemed to be reading, talking, discussing, arguing. It was intellectual searching in action. They weren’t there for a credential, a license, a job – they were there to learn, to grow, to find themselves. Many were not students, or were ex-students. They were often jeeringly called ‘professional’ students. Many had little or few apparent resources, but they existed, survived, and intellectually grew. We would just say, ‘It’s Berkeley’.

In the years 1959–1962 my major concern was Vietnam and the draft. I was in Air Force (AF) ROTC, so I was fairly safe. The first two years were mandatory for all male students. But in Year 3 I went ‘upper division’, meaning I was seriously planning and preparing for an officer commission and for some years with the Air Force. Because I could still play trumpet I opted to be in the ROTC band for the first 2 years, meaning that I didn’t get any field marching experience. My only military training was the textbook learning in the sitdown Air Science course.

As an upper division officer candidate, I had a group of first and second year ROTC students under my direction (command!) on the marching field. I was their leader and role model. But I didn’t know how to march, do formations, give directions, etc. After a series of embarrassing situations, like marching my group into another one, I ask to be released from those duties, and indeed from upper division ROTC. I was pleased, but a bit surprised, when the exasperated officials agreed – and I became a civilian once more.

But it was also a concern. I was now more subject to the draft, which didn’t end nationally until 1973, some ten years later. Most college students in good standing were granted educational deferments, so my worry was a mild one.

## Hello to Barb, Bye to Berkeley

In early Spring 1962 I worked at the Main Library Reserve Book Room (RBR), a very busy, bustling place. And there I met (although I had noticed her earlier) a 5 foot two woman with beautiful blue eyes and a radiant face – and very long black hair. That was – and is – Barbara! – although her hair now is much shorter and white.

RBR was a crowded, busy place. We checked out reading materials for 2 hour and 1 day periods. There was great demand for many of the materials. All those returning materials meant a lot of shelving of books. Much of the job was in the adjoining stacks (tall shelves) retrieving and refiling books. I liked to walk fast and would actually enjoy almost jogging the stack aisles with an armful of books. And – as the largely true story goes – I went around the corner with such an armful and ran into Ms. 5 foot two with her arms full of books. It was a delightful crash introduction – with books all over. We joked later that we had been carrying HQ books. Berkeley was an advanced library – we used the Library of Congress classification system. Later, we spent some time in the QM and QP areas. There was some mutual interest and attraction, though I was shy and so was she.

We'd joke and interact while working. It took an observant supervisor who kindly suggested I walk her home late one evening as we closed up. She lived on Hillegass Ave. I lived some 8 or so blocks away on Dwight Way. On the way to her place we walked in front of the Student Union near Sather Gate, and stopped for a drink. She ordered a lemon coke. I found that exotic and even alluring. I was hooked.

My fall semester 1961 grades were all C's: Economics, Philosophy, and two math courses – clearly I was, at best, mediocre Berkeley material. I can't even remember the economics or philosophy course! Early on in my Berkeley career I had stumbled across my registration file, perhaps via talking with a counselor, and learned that the IQ on my high school papers were a few points lower than the typical Berkeley IQ. That didn't do much for self-confidence or intellectual security! So, although in 'good' standing, I dropped out about March, 1962.

The drop-out counselor said something about not going through life ‘burning my bridges behind me’ – more self-confidence depletion.

I resided at Barrington for my 2 ½ plus years at Berkeley. After dropping out in March, 1962, barely in good standing, I continued to reside at Barrington until semester’s end. But I now had two serious problems:

I was now a UC-Berkeley drop out – and subject to the draft. My student job and deferment were gone.

More importantly, I wanted to keep seeing Barb.

I had somehow acquired Dad’s beautiful, fairly new, bright blue Renault Dauphine sometime in that early third year. So I had wheels. After working at Cutter Labs in Berkeley for a month or two I got a job at the UC Richmond Field Station, in a hangar helping to build an experimental wind tunnel, commuting via my blue Renault.

I would leave notes, messages, for Barb on the RBR staff bulletin board, but we did not regularly date or otherwise see each other. The Barrington accommodations, and the Richmond job, ended in June. Then it was back to Union City, home, and being a summer postal carrier.

*And now a miracle begins...*



# The ‘Miracle’ Years – the 60s

*Summer Miracle • San Jose State • Coop Engineering and Personal Values  
• Work, Cars, Physics • Adios, Renault • Barb and PCV • Jumping and  
Falling • The JFK Assassination • Outings with I&S, T&J • Barb’s Back!  
• To Denver • Solo, Just Barely! • Christmas and Barb? • Miracle #2 –  
Mrs. and Mr. • Retrieve Bride via Nevada Whorehouse • Reception and  
Denver • Perdido, South Emerson, Adventures • Grad School, DRI, DU  
• Traveling Together – Time Zones and Grau • Residency, Predecki,  
Library, Vroman • Olsens, Northern Lights, and Stockholm • Here Comes  
Tonio! • Research, Vroman, Albumin • Chinook, Rh, Tonio • Surface  
Science, Dissertation, and PhD • On to Utah...*

## Summer Miracle

SUMMER, 1962 WAS my last time as a fill in vacation mail carrier in Union City. Lots of walking, adventures with dogs, and time to think. I had aspirations to major in Electrical Engineering that fall term, as I knew I didn’t have the brains for physics or math. Why not San Jose State College (SJSC) – nearby,

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cheap, probably not too difficult? I enrolled. My high school buddy, Igor Skaredoff, was also there. Although Tom was to be at SF State, he changed his plans and joined Igor and I at SJSU in Fall, 1962.

Barb continued at UC-Berkeley, entering her 4th year, with aspirations for the Peace Corps. We had not really been in touch after that lemon coke and evening walk to Hillegass.

Tom and I met up in late June, 1962, in Berkeley, to visit, talk, and contemplate our futures. We were in the Student Union – and then – Miracle #1 happened. There was Barb, with her smile and beautiful blue eyes – with some guy. We all sat down together, her friend was distracted via munching Tom's popcorn. We talked, laughed a bit, and then exchanged contact information, perhaps about getting together. Then back to Union City, home, and the US Post Office (USPO).

Mail carriers in Union City, after their mail route was finished for the day, would return to the post office and sort the afternoon mail, in preparation for the next day. On the afternoon of July 3, I was sorting and came across a short letter – addressed to me! – from Barb! She was in Berkeley, attending summer school. There was a return address on it!

July 4 is a Federal holiday. I had no plans. Although I had no phone number or direct invitation, I did have her address and a lovely blue Renault – and Berkeley was only about 45 minutes away. So July 4 morning an excited Joey goes to Berkeley, finds Barb's summer domicile on Northside, and knocks on the door. At first I thought she wouldn't be home, or if she was she'd have to study, or she was busy, or with someone, or...

She answered the door! She said something about not wanting to study. Off we went. First to the Berkeley hills regional park, some park swings, walks, an enjoyable afternoon. Then San Francisco came up. She'd been born there and had a fascination for The City. Why not? So off we went – probably over the Bay Bridge – to Golden Gate Park, then walking, swinging, laughing, talking. At one point our hands touched as we walked. Then to Market Street for some greasy chicken. We noticed the film *West Side Story* was playing nearby. In we went. What a perfect film for a budding relationship! Barb was my Maria. I wasn't her Tony yet, but we did hold hands. A great beginning – thanks to a late July 3 letter in the US Post Office – and that earlier lemon coke – and those blue eyes – and Tom's popcorn. And that was the real beginning.



We met and dated all summer, sampled *Carrot Cookery* (a home-made cook-book she prepared for me, as I would bring bags of carrots to her and her room-mates), and explore walking trails, swings, and parts of the nearby coast. We continued dating through the next school year, until she graduated and then went away for Peace Corps training in July, 1963. She was then off to Colombia as a PCV for the next two years.

We talked and talked. There was one evening talking in the car, parked and nuzzled together in the Mill Valley park near the library, when a policeman tapped on the window asking if we were ok. We were fine, although Barb confided to me some moments later she'd prefer a passionate knight on a white horse. That was apparently not me. We talked. We wrote. We dated. I courted – clearly more smitten than she was.

I recall one drive together, perhaps heading to Santa Cruz for a day at the beach and Boardwalk. We rode the roller coaster – she did not like that one bit. On the way home we listened to the then popular Gail Garnett song:

*We'll sing in the sunshine  
We'll laugh every day  
We'll sing in the sunshine  
And I'll be on my way  
I will never love you  
The cost of love's too dear  
But though I'll never love you  
I'll stay with you one year.*

The lyrics seemed to fit us at the time.

Obrigado Pela Vida

## San Jose State College (SJSC)

Igor and I rented a house in SE San Jose in early Fall, 1962: 1167 Lynn Ave. Tom planned to join us later in the year. We did yard work, turning soil with a claw hammer, according to Tom, even planting. Igor introduced us to ‘Skelly Greens’ – a strange new green cocktail. He also taught us how to make modern, inexpensive couches. He became annoyed when I asked Barb to dance on them during our 1962 New Year’s eve party – we were all lightly inebriated. Igor had a good collection of records. He provided some of my first exposure to classical music. Barb and her family then continued that exposure and education. Tom taught me how to take power naps. He would nap for 15 or 20 minutes, and then wake up at the precise time he planned. He loved to talk, and I often had to close my bedroom door with him in mid-monologue to get needed sleep.

## Coop Engineering and Personal Values

I had enrolled in San Jose State’s Engineering program, initially in Electrical Engineering (EE). A required course in Materials Science and Engineering (MSE 25) led to Dennis Olsen, who became a lifetime friend, and to Zuhair Munir – a young Berkeley graduate student finishing his PhD with a teaching stint at SJSC. Prof. Munir’s MSE lectures were amazing – clear, concise, well diagrammed and illustrated, and fascinating. He opened up new technical arenas for me; I almost immediately became an MSE Engineering major – my fourth undergraduate major! In some of the other MSE courses I learned a little about biomedical materials, gave a student seminar or two on the subject, and got self-directed to the biomaterials subfield of MSE.

James Anderson, MSE Department Chair, was a cigar smoking ‘doer’. He wanted an x-ray electron microprobe for the Department, and managed to get

one during my studies there. He would host public engineering days and show off equipment, including an electron microscope and the to-be-obtained electron microprobe. He once boasted:

“I’ll buy it in pieces via petty cash, if I have to.”

He did eventually obtain one. It was a brief lesson in persistence and getting things done.

The MSE students had a room available to them to serve as a place to meet and develop collegiality and support each other. We had various discussions. Dennis recalls our discussions of Paul Ehrlich’s then new and controversial *Population Bomb* – only two, only two! Dennis also recalls many other events which I don’t remember. He stayed in touch with several others in our class over the years – I did not, except for Dennis.

At San Jose I did well, made the honor roll, got invited to join the campus honor fraternity, Tau Delta Phi (TDP). The honor society’s ritualistic and intellectual initiation was a major eye-opener for me, leading to the taking of two wonderful philosophy courses. I became seriously involved in TDP’s ideals and projects in 1964–65, including the development of The Tower List, one of the very first faculty evaluation by students efforts. It was controversial (details at [www.joeandrade.org](http://www.joeandrade.org)). I got involved in campus debates – there was a free speech area I frequented and even used. Much more was going on up the road in Berkeley, documented much later in the film *Berkeley in the Sixties*.

There was a small set of required engineering core courses, one of which was Dynamics. I recall lectures on analyzing auto crashes – to figure out what happened and who was likely responsible. One of the concepts used was different coordinate systems. We normally operate in a Cartesian (x, y, z) coordinate system; it was interesting to learn of others, such as polar coordinates. Also to consider levels of coordinate systems. The ‘stationary’ me in a moving car, a stationary car on a moving planet, etc. And of course means to change or transform coordinate systems – like taking different perspectives or points of view. I did have an interest in math after all.

Statics, the prerequisite course to Dynamics also opened my eyes. One of the books I bought to supplement the course notes and text was *A Stress Analysis of a Strapless Evening Gown*, which had just been published. Very practical.

An Intro to Engineering required course really impressed me. It was about creativity, problem solving, doing practical projects. One of my designs for the

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course dealt with a rural mailbox a long distance from the owner's house. How could the owner know if mail had been delivered that day? That was a fun project – and perhaps even patentable.

Via the cooperative engineering program, in Spring I worked in Tracy, Red Bluff, and Anderson/Redding helping install VOR systems for aircraft navigation. VOR stands for Very-high frequency Omni Range – navigation systems we installed at various airports.

The work was for some 3–4 weeks at each site, moving on to the next Federal Aviation Administration (FAA) assignment via the local office in Burlingame. It was great. I saw some new country, learned useful skills, made money – even doing local odd jobs.

One such gig involved a driving job in Williams, just down I-5 from Red Bluff. An elderly couple engaged me to drive their house trailer from Williams to Ukiah, because the man's vision and thus driving was compromised. I took on the job, 'assured' him that I did have trailer-driving experience, and could safely transport them along the beautiful, very curvy road from Williams, around Clear Lake, to Ukiah. We survived. He took the wheel at the Ukiah trailer park to back the mobile home into its assigned spot. We parted friends. I may have hitch-hiked back to my car in Williams – maybe it was by bus.

Most importantly, the FAA jobs meant Barb and I had time to continue courting. I recall one road trip around Clear Lake. We needed a bathroom stop. We joked we could write a guidebook to publicly accessible restrooms in Northern California! We might include a section on swings – we both loved to go on swings. We corresponded, talked, and dated as she was completing her studies and preparing for PCV training. When I was in Tracy, CA. for coop engineering work, we had some exploratory adventures via a shower in my room in Tracy – we expanded our latent QP interests. She was safely introduced to Puppy, who made an impressive presentation. On the way back to Berkeley we were driving almost adjacent to a small airport. Always interested, I was looking too intently at the planes, and begin to cross over the white line. Barb noticed it and quickly corrected our trajectory. I was impressed, noting how alert and effective she was (and is).

We wrote and sporadically dated. and went on short trips, hikes, adventures – including the Sonoma Coast in early July, just before she left for PCV training.

During Spring into Summer, 1963 Tom, Igor, and I exchanged letters and discussions related to girls, love, marriage, careers, philosophy, futures, etc. I was focused on Barb, Igor had not yet found Shirley, nor had Tom found his Judy. A bit later Igor found Shirley, even later Tom found Judy; we all became close friends. We studied, worked, went many places and had adventures together. It was no longer Igor – it was I&S – Igor and Shirley. Ditto for Tom and Judy.

## Adios, Renault

Tom, I think, and I were headed North on Highway 1, far west of Santa Rosa – some time in early September, 1963. Thankfully, Barb was not with us. She was doing her PCV training in Albuquerque and Taos. The Renault Dauphine was woefully underpowered. So if there were hills, we'd generally get up speed on the down run to be able to get up the next hill aided by momentum. We were cruising down. There was an intersection. Two cars were stopped in front of us, one waiting to turn left and the other also waiting to turn left. We had the right of way. As we approached the intersection, the westward oriented black Cadillac suddenly decided to enter the intersection. I braked and turned towards the southbound car also waiting to turn left, thus avoiding the now stopped Cadillac. Then I swerved back to the right to avoid that south-oriented car, but clipped his front bumper-fender. We fish-tailed a bit, didn't roll. We were fine. Both cars stayed and we exchanged details. A policeman came. The guy who stayed stopped reported to the cop that the Cadillac had pulled out prematurely. All was well, legally. We did very slowly drive the wounded Renault to a garage, I think in Santa Rosa. The Renault, it turned out, was 'totaled' – it would cost far more for repair than what it was worth. So I bought a cheap, used green large Chevy, and went home, essentially unscathed. The lovely Renault was gone. Barb and I had lost a good 'friend'.

## Barb and PCV

In early July, 1963 Barb left for Peace Corps training in Albuquerque and Taos. We wrote. She returned for a week in October. I visited her in Sausalito; her family was living there in a home owned by the Roths, long family friends and her father's employer. Her family was housesitting for the Roths. I was in the big green Chevy, the set of wheels that replaced the lovely but totaled Renault. The courting did not really go well. I blamed the Chevy.

She shipped off to Bogota, Cali, and Dagua, Colombia in late October 1963. We agreed that I should not see her off at the airport. She didn't like goodbyes, and neither did I. We wrote – lots.

I saved her letters; she didn't save mine. I missed her.

I & S married in June, 1964. Igor just made it to his own wedding, as Tom and I inebriated him at a party the night before. Tom and I wore black handkerchiefs at the wedding. T&J married a year or so later, I think. Many decades later, Barb recalled Judy talking about Tom:

'He's so cute!' she purred.

## Work, Cars, Physics

The coop engineering program had taken me to Red Bluff, CA, staying at the Tremont Hotel. Red Bluff is close to the foothills and mountains of Lassen National Park, where there was a beginner's slope for largely unsupervised skiing. I rented some skis, drove up, watched some people ski a small beginner's slope, and gave it a try – no lessons. Gravity is a powerful force!

I pointed the skis down the hill, gently pushed off, and began to move – faster and faster! – crashing at the bottom of the hill in a snowbank. No damage. There was a small rope tow with which to get back up the hill. Little kids and their parents were effortlessly hanging on and sliding back up the hill. I gave it a try – several times. Very tricky. You have to get close to the rope and grab it while it's moving, jerking you from a standstill to the rope velocity in a

split-second – without falling or impacting the others hanging on and moving. I knew I was terrible at balancing – the rope tow reinforced my physical insecurities and inadequacy. But I had been 'skiing'!

For the Redding job I lived in Anderson, cruised around Mt Shasta and frequented a wonderful local library in Redding. Red Bluff and Tracy also had cool libraries. In the Tracy one I tried to over-optimistically translate Barb's *Querida* and *Querido* greetings in her letters! Igor's letter to me in Red Bluff did not need any translation. He was now dating Shirley and fully smitten. Tom had been with a Deb, but was clearly still looking.

us Steel in Pittsburg, CA provided a summer student traineeship in July, 1964, a benefit of the coop engineering program. A boarding house on 928 Black Diamond Street in Pittsburg provided a bed and meals, served by a tough, no nonsense, quite robust owner-manager. us Steel kept me on part-time (weekends) into the fall term that same year. I learned practical steel metallurgy, issues with unions (I almost caused a union shutdown of the plant by trying to take my own steel samples for analysis). Chronic impatience strikes again!

Chronic impatience led to a physics experiment on a curved road enroute to the us Steel job early one morning. I'd never heard of 'black ice'. I never forgot it. The green Chevy in a ditch, stuck, a tow truck driver snickering at this dumb kid. I was very late for work. And then sometime later in San Jose, headed North on 101, the brakes disappeared. Brake pedal went all the way to floorboard! I was coming up on an upward inclined exit ramp, coasted up, merged with the cross traffic, pulled over and fortunately ran out of inertia and momentum. I had to go through a red light in the process. The inspecting officer smelled brake fluid. He believed me. And I quickly got rid of the Chevy for a vw Beetle. vws have traction – even a bit on black ice.

The vw bug was really cool. I loved it. It had no gas gauge. You just had to know how much gas the tank held, your mileage, and how far you intended to drive. It was up to you to figure out when you needed gas. There was an emergency option to running out of gas. If the engine began to sputter due to lack of gas, the driver could open a small 'valve' on the floorboard with her foot. This spare tank held a gallon or so – enough to get the car to a gas station. Cool and clever. Drivers in the early 60s had to be more arithmetic literate than almost anyone is today. The little spare tank reminded me of a spare, emergency parachute. Interesting.

## Jumping and Falling

I'd always been interested in parachuting. I'd heard the stories of paratroopers, and of test pilots auto-exiting from their experimental planes. On the way up to Red Bluff for that first coop engineering assignment, there was the local airport, just south of town. I stopped. There was a small office and snack shop. Yes, there were parachutists that used the airport and a small, local club.

"That's the plane they use," said someone, pointing to a small, low-wing trainer-type aircraft not too far away. I inquired.

The club provided an hour or two of ground training – how to land, tuck and roll, and how to disengage the parachute on landing. That was it. They didn't have any jumps scheduled. I waited. One weekend, hanging with them at the airport, their pilot showed up. He was an on duty California Highway motorcycle patrolman. He was willing! I strapped on the club's beginner parachute; the spare safety chute went on my front at belly level (just in case the main one doesn't open).

Up we went – on April 28, 1963. I had been told the process. The plane slowed; he motioned me to the wing of the cool WWII trainer (perhaps a BT-13). I crouched while holding on to a handle on the fuselage, and – when he gave the word – simply let go of the handle and gently went off. I did what I had been trained to do – just let go. I was sure I'd get banged by some part of the plane. But its flight speed and my wind resistance guaranteed an essentially straight down drop. Gravity rules! I fell, but then a second or two later there was this horrendous jerk. The plane's tail hit me!

It hadn't, of course. It was just the static line – the tethered ripcord – engaging. A tiny chute popped out, a big beautiful parachute slowly inflated, and it was a quiet, slow, almost serene way down. Really cool! According to my then brand new *Parachutist's Log Book*, at entry #1, there is a dated signature by an S Scott. I don't recall the landing. It was near the airfield. As it was a home-modified military parachute, the vertical landing speed was probably about 15 miles/hour. No sprained or broken ankle. Alleluia!

I almost immediately called home. Dad had been opposed to my jumping, threatening to disown me if I got hurt. He answered the phone.

"Well," he growled.



“I did it.”

There was a brief silence.

“Well, how was it?” he asked enthusiastically, laughing.

I bought the parachute I had used from someone in the club. I repacked the modified military chute per his instructions and supervision, learning the standard mantra – ‘always pack your own parachute’.

But I ran out of time in Red Bluff for any additional jumps.

In February 1964 I began seriously skydiving at the Elsinore CA Paracenter (I learned of it via a popular TV show of the time, *Ripcord*). The Paracenter was located about 30 miles from the coast, and halfway between LA and San Diego. The Elsinore people ran me through a second ground school and had me do three static line jumps before the real one. We were taught about stable body positions. The goal was to leave the aircraft in a spread eagle position, to use your full body as a drag enhancing object. Then, at the appropriate time, bring your hands and arms in to your chest, symmetrically, grab the ripcord handle and pull it by extending the arms out again – all the while staying in that stable spread eagle position. That was the idea. The reserve chute around your waist had an easily visible altimeter on it, so you can see how fast you’re dropping and how much time you have. The parachute takes several seconds to fully inflate. A typical safe height from which to deploy is no less than about 2000 feet.

After three successful stable static line jumps, I could solo – meaning I’d free fall for 3 seconds, then pull the ripcord manually, hopefully without rolling or tumbling in the sky. From then on it was higher and higher jumps and longer periods of free fall.

I can still hear that first stable free fall jump. You let go. It’s very noisy, but in a split second the plane is long gone. The noise you hear is the noise you and the air make as gravity pulls and accelerates you downward. As the air passes over you you hear a pitch – that pitch gets higher and higher as you approach terminal velocity. In about 3 seconds or so you’ve achieved terminal velocity, just over 100 mph if you’re falling in a stable spread eagle position. And then the pitch is steady, unchanging. It’s incredible. If you jump from about 5000 feet, you have about 10 seconds of free fall; 30 seconds from 10,000 ft. Of course the higher the altitude, the longer it takes the plane to get up there – and the more expensive the jump. I did 16 jumps at Elsinore – the highest were from 4500 ft, with a 15 second or so free fall.

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I was on a very low budget and had to sleep in my large green Chevy. I managed – by buying two 1 x 10 inch planks, about 8 feet long. I placed them in the car from front to back, supported by the dashboard and the front and back seat tops. I tried to keep a roll of foam pad between me and the very hard planks. I did manage to sleep, although it was also very cold at night. What you can do when you're very young!

Later in Hollister, CA, in Spring 1965, I did another 20 jumps from March until early July – when Barb returned from her PCV work and travels. The last several jumps in Hollister were from about 7200 ft., nearly 30 second free falls.

Our parachutes were semi-controlable. We could open or close a patch of the nylon near the upper half of the chute. The air escaping through the patch would rotate the chute, allowing us to semi-navigate towards the target on the ground. We had some experience observing the wind detection pylons, common on airport properties. If the pylon extended more or less straight out, the wind was in the range of 15–20 mph, generally considered unsafe for jumping. The concern was when you land and the chute is still open, not yet collapsing, that wind allows the chute to become a sail and drag you around the airport! We also had quick release shoulder straps so that immediately upon touching the ground we could release one of the straps, initiating parachute collapse.

In Hollister I met fellow skydiver Hugh Barber – we quickly became friends.

One weekend when I was not there, Hugh had a serious accident. He was part of a group jump. One of the jumpers routed over his parachute on the way down, sort of 'taking' the air, leading to a partial collapse of Hugh's chute. He landed very hard, was taken to the hospital, and took many months to fully recover. I visited him several times in the San Jose Hospital where he was treated and recovering. Later he moved to Alaska, and built his own experimental plane. We haven't seen each other in decades, but have talked via phone and email.

My jumping out of airplanes 'career' totaled 37 jumps, most evaluated for target accuracy (how far you had to walk to get back to the airport and your car) as TFTM (too far to measure), many as TFFT M (you figure it out!). That makes me a mediocre skydiver. No more jumping, until Jump #37 – nearly 30 years later – in Salt Lake City, a tandem, with friends: Aug. 14, 1994.

## The JFK Assassination

President Jack Kennedy was killed around noon on Nov. 22, 1963. He had been President for just over 1000 days. My very dull physical chemistry class had just ended. I recall leaving the building and seeing students – alone and in small groups – holding their little 9 volt transistor radios to their ears. They were quiet and serious – clearly not normal.

“What’s going on?” I asked one couple.

“Kennedy’s been shot – just now – in Texas.”

We were all floored, almost in shock.

College students loved Kennedy. He was young, educated, charismatic, honest – our hero.

He had replaced the nefarious, evil, whiney, and crooked Richard Nixon – who didn’t trust students or education. Kennedy had just launched the Peace Corps. He was a breath of fresh air, of optimism, of competence, of creativity.

Barb had just arrived in Bogota, Colombia to serve as a Peace Corps volunteer (PCV).

Here’s her recollection, from her self-published memoir *Innocence Abroad: Experiences of two Peace Corps volunteers, 1963–1965*, copyright 2019:

As I write this it is 50 years since the assassination of President Kennedy. Those who didn’t experience it cannot know the indelible mark it left on everyone’s memory. We all remember where we were and what we were doing when the news was broadcast. In our case, Becky and I were walking down the hill to meet with some friends who were going to cut branches and teach us how to make our table and two chairs. As we passed by houses, the radios, always loud, seemed louder than usual, and everything else was quiet. We heard the news, President Kennedy had been shot, and the American national anthem was played right after. Becky and I started crying, and we hugged one another there on the road. It didn’t seem real.

The Colombians took it hard as well. Three days’ observance was declared by the government. No music was played on the radio except for religious or classical. Plays and movies were cancelled. People wore

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black. We felt awkward that we had no black clothing, but we were given black armbands to wear. Almost every house displayed a Colombian flag tied by a strip of black ribbon. Colombians would come up to us to offer their personal *pesamé* condolences. It was so very touching.

Lyndon Johnson was no Jack Kennedy. Suddenly our future, our optimism, our hopes and dreams were shattered. Vietnam was ongoing and expanding. We were fearful, demoralized, disappointed.

## Outings with I&S, T&J

I had a job in the SJSU library for a short time, tutored, jumped in Hollister, and dated a girl from LA who'd never seen a cow!

Igor knew this great hike and lake in the Sierras – Lake Winnemucca. T&J and I went camping with I&S in the summer of 1964. It was a magical, beautiful place. My platonic partner was Cathy Swoda, who was one of the literary crowd at WUNS. I fantasized taking Barb to Lake Winnemucca.

I think Tom, Judy, and I finished SJSU and graduated at the same time as Igor and Shirley – Spring 1965. Igor and Tom had been concerned about getting a job, I'd been applying to grad schools.

Tom and Igor liked beer; we had an empty aluminum beer can pyramid in our front room. I drank some, too. I was very fond of Wheat Chex for breakfast. During one of our more creative cooperative sessions, we penned 'Wheat Chex are for Me!', a rhyme (unfortunately not yet lost to posterity). Finally Dow Chemical in Martinez came through for Igor. We had a party, singing 'A Job Offer', to the 'tune' of the Wheat Chex song.

T&J got their CPAs and worked for a big accounting firm. And I went to grad school in Denver, after a summer job at NASA in Moffett Field, just up the road, making 'internal friction' measurements (I forget why).

## Barb's Back!

Barb returned from her PCV service in July, 1965. Her Mom, Le, met her in New York and they visited NYC and the Chicago relatives. Barb reconnected with her good-looking Chicago cousin, Mike Arnow. She came home. We began dating again.

The magic of Lake Winnemucca beckoned. We went in late July, 1965, this time Barb and I with T&J, I&S. We routed via south Lake Tahoe to meet Den and Mill (Dennis and Milly Olsen). Milly taught middle school in Salinas after graduating SJSC; Dennis was my MSE classmate and lab partner. Their little Triumph was packed to the gills, with a copy of Camus' *Resistance, Rebellion, and Death* prominently displayed inside the rear window. Dennis and I liked Camus. We said goodbye. Then Barb and I headed for the Lake Winnemucca trailhead to meet T&J – I&S. Tom had this enormous, heavy tent he had rented. He wasn't really a camper. But we made it up the nearly 3 mile trail, largely in the dark and under the influence of Tom's bottle of cheap Thunderbird.

Barb and I were in a little tent. It was cold, it rained, we could feel water moving under the ground cloth of our well located and placed tent. It was wonderful. We washed in an ice cold little stream, causing Puppy to condense and retract as much as he could – smaller than I thought possible. We watched dramatic sunsets, hiked. Magic. Packing out to go home, above timberline, there was a lightning storm – at 9,000 ft or so. It was striking around us – no cover. It was literally electric! We could smell the ozone created by the strikes.

"I hear you, Lord!" I hollered.

Barb was calling for Santa Barbara.

We all survived another terrifyingly wonderful experience.

That summer of 1965 was a period of deep introspection for me. Marriage? Barb wasn't very interested in it, and I also had major concerns. Career? Metallurgy, materials, journalism? Research? Teaching?

After searching for and applying to several grad schools, I had several offers. The best and most interesting was the University of Denver – on an NSF fellowship. It paid tuition and provided a very adequate stipend of \$200/month for up to 3 years. And I wanted to see and experience Colorado, having never been east of Reno.

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Barb and I had a long evening discussing marriage? Passion, knights on white horses...

I left. Barb enrolled in San Francisco State; we wrote.

## To Denver

In September, 1965 I went off to Denver in the blue vw I had acquired earlier to replace my bad luck Chevy (brakes!). I wanted to see the Grand Canyon, so routed South to Henderson, camped at Lake Mead, then the next day to Grand Canyon, via Williams, AZ. On the way into the Park I noticed an airport with the sign Grand Canyon Scenic Flights. I booked one and flew into the outer, wide canyon. It was a small plane, perhaps just 5–10 seats. We then flew down into the inner gorge – it was literally wall to wall gorge on both sides of the plane. You felt you could almost touch the walls. Thrilling! (Flights into the inner gorge are no longer allowed, although I'm not sure they were 55 years ago either!). From Grand Canyon I drove to Cortez, CO and Mesa Verde National Park. Durango was next, then up through Silverton. I learned to respect and take literally the high mountain Slow to 10 mph road signs – even in a vw Bug. Then, probably, on to Gunnison National Monument, Monarch Pass, Colorado Springs, and Denver.

Via DU student housing I found and rented a garage room at 2812 S Gilpin St, owned by a Mrs. Patania, with a parking spot for the vw. DU was within walking distance; I could also drive – parking and traffic were not issues. The room had a tiny bathroom and basin, and a toaster-oven. I was fond of Beefaroni at the time as well as Ramen noodles. There may have been a hot plate for making tea and coffee. There was space near the window for a study space and a good view of vw in the driveway. Barb told me decades later that I had told her that, because the room did not have a refrigerator, that I told her I kept some items modestly cold via placing them in the toilet tank! I don't recall that, but it makes sense even now. Flexibility and resilience rule!

Denver Research Institute (DRI) provided an office in a house adjacent to the DRI research building, just a block from the Engineering building. I started getting acquainted, meeting the professors, and registering for classes.

Even though I had a good stipend, I sought and did part-time work, especially on weekends. I loved tutoring high school students. I worked as a handyman, painter, gardener.

## Solo, just barely!

After getting settled, enrolled, and involved, I decided to take flying lessons at the local Columbine airport. Mr. DeCastro was my flight instructor. After some ground schooling, he took me out in the school’s Cessna 150 on Oct. 11, 1965. From then to Nov. 19, according to my ancient Flight Log, I flew about 8 hours, soloing at about hour 7. I thought it was too soon (It was!). DeCastro must have been tired of me. That first solo flight I had real problems. Take off was easy, of course, but landing! I had come quite close to the 2nd floor control room (no tower there), so close I actually saw people running from the room. My confidence well shaken – and all alone in the cockpit – I tried to land. First time I hit hard, bounced and launched, and went around again. The second try didn’t work either. Around again – I couldn’t procrastinate. Then I landed again – hard. The landing gear didn’t buckle; back on solid ground. Not only had I been a mediocre Berkeley physics student, I was a lousy pilot – as well as mediocre skydiver. And Barb was far away. I did not continue for the Private Pilot License I wanted.

## Christmas and Barb?

Back to the books, tutoring for dollars, and preparing for finals. Barb and I exchanged many letters, each cautious, concerned, and anxious about seeing each

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other. We were still shy, questioning, non-committal, wishy-washy, and confused. That would continue.

Dec. 15, 1965 – home in Union City after 29 hours in the vw. Barb was at a stag Latin American dance at SF State. We met the next day or so – and talked – many times over many days. But then she'd see that passionate guy's white horse, rearing up – and back to confusion, uncertainty, freedom, independence – and loneliness.

As I write this, revised in 2021, I'm looking at the beautiful book *Flight*, Barb's Christmas gift to me of 12-25-1965. She wrote:

"You too will soon have your wings."

I assumed it referred to my pilot's lessons, but... maybe not.

We broke up... the night of Dec. 27, probably parked near her parents' home at 516 Throckmorton in Mill Valley. Barb recalls that I wanted commitment. I did. I also wanted more. And Puppy was increasingly interested and persistent. Barb, wisely, was less so.

The next day, wounded, I called Cathy – hadn't seen or talked with her in years. Her Dad answered... he slowly, hesitantly said she'd be getting married in a few hours! Oops.

Jan. 1, 1966 – a motel in Grand Junction, enroute back to Denver. She's gone... maybe forever...

And then that part of my Summer 1965-1966 introspection journal ends... the next pages are by Barb (and me) sketching and listing what kind of home we might want!

Here's what happened:

## Miracle #2 – Mrs. and Mr.

She wrote. We were still in touch, longing, wanting, questioning. Several letters back and forth – last one on Jan. 20, 1966 – just days before her birthday – still indefinite, confused. SF State ended its semester about Jan. 20. We continued communicating by phone. Barb and I pondered our conflicting, confused thoughts and letters and decided we needed a woman-to-man direct discussion!



So Barb boarded a Greyhound bus to Denver. I met the bus downtown. I took her to 2812 S. Gilpin – and we talked and talked and ...

Mrs. Patania was furious that I had a woman in my 'apartment'. She threatened to break into our little heaven, call cops, and evict me. I agreed to promptly vacate.

We kept her at bay  
as Barb had decided to 'stay'  
for more than a day.  
And the cops stayed away.  
Hip, hip, hooray!

We drove, explored, enjoyed, discussed, confided, and eventually agreed. We mutually proposed in front of the DU administration building, in the vw – and agreed to get married. I promptly reached for and passionately kissed her hand. She started laughing. I had fondled and kissed, inadvertently, my own hand!

Then I got busy. We needed a place, fast! We found a small backyard alley cottage at 1267 South Emerson, barely North of I-25 and a few blocks west of Washington Park.

We rented it. The house in front housed two curious small boys. We moved in quickly so Mrs. Patania's neighborhood reputation would remain unsoiled.

We needed a marriage license, which required blood tests in Colorado, which took 52 hours to process. The results were interesting, even concerning. I am O+, Barb is A-. We knew enough about blood and marriage to know that was our one important incompatibility. Now a new research subject – Rh incompatibility.

We had often gotten lost during our road adventures, and credited the car, calling it Perdido. So marriage morning Barb found some white paint and christened the dark blue Beetle P E R D I D O in large bright white across the back. She also shined my 'dress' shoes for the big event later that day, noting one of the soles had a large hole in it. I had a seminar to give that day and a chemistry class for my semi-delinquent parochial school students – a part-time teaching job.

Arnie Paddock, a fellow DU grad student, and Barb Siani, a returned PCV who served in the Colombia group with Barb, served as our two required witnesses. We agreed on two inexpensive stainless steel rings. The platinum ones

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I ‘promised’ for later never materialized. Barb and I rushed to meet Paddock and Siani at the courthouse in downtown Denver before it closed for the day. I received a speeding ticket.

We were served by a friendly efficient judge, who asked the right questions, and (*Miracle #3*) we said “We do!”, exchanged rings, were declared Wife and Man – and left to celebrate. Barb clutched the newlywed pack the clerk presented to her. I clutched our new Marriage License. Out at the curb Perdido had been violated with a parking ticket.

We went to a local cafe on Evans Ave., near DU. Arnie ordered Scorpions for us (we haven’t had one since). We got inebriated, and Barb and I went to our newly rented cottage to begin married life.

Barb called her parents. I called mine – Dad’s response was almost predictable:

“Jesus Christ!”

Dad – and Mom – were clearly pleased.

A week later the formal Certificate of Marriage came by mail; marriage date Feb. 4, 1966.

Barb had decided to return to Mill Valley so she could return to SF State for the Spring term. We’d be married, living over 1000 miles apart. Crazy? Yes.

Thank you Arnie Paddock and Barbara Siani – and thanks Mrs. Patania for empowering – insisting – on our escape from confusion, indecision, and loneliness. Feb. 4, 1966, exactly 43 months from that July 4, 1962 first ‘date’. We were elated, finally realized we were indeed in love, and prepared for Barb to return to California! But we did have a few wonderful days before she reboarded Greyhound. Her folks wanted to do a reception at their home in Mill Valley. We made some plans.

DU was on the quarter system. There was a Spring break a month or so later, so I made plans to drive out to California to see my new bride. Barb says that, as she was on the bus in Denver, looking down through the window at me, waving goodbye (I was probably in tears), she started having second thoughts about continuing at SF State as a bride in abstentia. Later we talked.

I continued working, studying, tutoring, planning, and probably crying. And also teaching semi-delinquents who fully understood the concept of simple harmonic motion better than I did – the girls included.

## Retrieve Bride via Nevada Whorehouse

Spring break was one week long; the drive took about 2 days in each direction. By then Barb had looked in to studies at the U of Colorado (CU) in Boulder and Denver. She decided she could continue her MA studies in Linguistics at CU, but would have to wait a year to qualify for in state resident tuition. So she withdrew from SF State, packed, and helped prepare our reception. Meanwhile I drove US 50 into Nevada on a very cold, wintry day. The plan was probably to drive straight through, perhaps taking a nap or 2 in Perdido, although it was very cold.

In the small mountain range about 5 miles east of Eureka, Nevada I dozed at the wheel, in the wee hours of the morning. I woke as Perdido was headed off the right narrow shoulder towards the edge of a small cliff. I overcorrected on the icy road, the car spun around, and slammed into a snowbank on the left side of the road – the back end of the VW pinned in the snow bank. That was the good news because otherwise I would likely have gone over that small cliff on the other side. The car was firmly stuck. The car looked OK, although I couldn't really tell. I must have had a small shovel, more or less standard equipment for remote travel in those days. Even after picking and digging in the cold, I couldn't get the car to move. Stuck.

Eureka, Nevada has been called the loneliest town on the loneliest road in America, that is US 50. I knew I was just east of Eureka. So I bundled up and started walking. It was a few degrees below zero. I knew Eureka was about 5 miles away – an hour and a half walk. I walked into the little town at about 5 am. There was an open coffee shop-diner with a police car in front of it. Another minor miracle. The policeman heard my sob story, and drove me back to Perdido. He looked at the situation, concluded the car was probably fine, pulled it out of the bank, cautioned me to never touch ice-cold metal or I'd lose my skin or even fingers (my metallurgy studies focused more on heat, not cold).

The car was okay. He told me to drive into Eureka, he followed. We pulled into the diner. As he returned to his rewarmed coffee and donut, he said if I drove on he would ticket and arrest me. He told me to go across the street. It was

the local whorehouse (I was in Nevada!) and it was always open. I did as I was told, got a temporary room and went to sleep.

Waking up several hours later I went into the bathroom. There was a door on the other side of it. I cautiously opened it. It opened into another bedroom with a large obviously occupied bed – a quite well endowed older woman was sleeping soundly. I gently closed her door, washed up, went back to the diner for a needed breakfast, and continued on to my new bride. I probably went straight to my parents in Union City to sleep. I then called Barb and recounted my Nevada whorehouse adventure.

## Reception and Denver

The reception was beautiful. Barb's folks actually printed marriage announcements which they had us send to friends and family. Great participation: my parents, little brother Manny, not so little brother Bob and his wife, Joyce, Uncle Manuel, Tom and Judy Hogan, Igor and Shirley with their Nick, and others. Nearly 5 year old Manny played with Jill, Barb's littlest sister, who was about 10. Barb's family and school friends were there, including her fascinating Mississippi-bred grandfather, Gramps.

The Williams family home at 516 Throckmorton in Mill Valley was beautiful, rustic, wooded, roomy, and had a large fireplace that her Dad, Julian, kept amply supplied with firewood. Her Mom, Le, was a great and insistent cook and baker. There was much music. Le was an accomplished pianist. My Dad and Uncle Manuel played some Portuguese guitar. Barb's brother, Rhys, is a flutist – and probably played, as did others. It was too soon over.

Barb had been given a corsage or some flowers, which she wore, and partially dropped, prompting her little sister, Antonia, to declare:

“Barbie's been deflowered!”

We overfilled poor Perdido with Barb's stuff, and headed home via Reno. We spent the night in a cheap motel, perhaps slightly East of Reno-Sparks. It was winter and cold. Barb's only real warm coat was a *ruana* imported by her from Colombia – essentially a small wrap around blanket. After checking in,

we went out to the car to fetch it. No ruana. She was devastated – sure she had packed it. We looked. Nothing. There were a few other cars at the motel; it was already quite late.

“Maybe someone stole it. Did you lock the car?”

She was nearly in tears.

“Maybe somebody saw something? Maybe somebody found it?”

I checked in the office. Nothing.

“Maybe you could ask someone?”

I saddled up the white horse and knocked on the first occupied door – late at night, cold, in red-neck East Reno.

“No, we haven’t seen anyone, no blanket.” said the first door, as did the second, politely closing quickly.

Meanwhile Barb had been rummaging through poor Perdido’s insides and found it. Allelulia! I hadn’t been shot, and she’d be warmer now. It wasn’t exactly our first wedding night. We were getting to know each other...

Eastern Nevada and later Eastern Utah were quite barren back then. We learned to get out of the car and pee downwind. We made it over Parley’s Summit, commenting to each other on the beauty and charm of Salt Lake City and the Wasatch Mountains. We then routed via us 40 to Vernal, Steamboat Springs, Rabbit Ears pass, Berthoud Pass, and into Denver.

Rabbit Ears pass just east of Steamboat Springs was terrible. It was snowing hard, partial white-out, dark, cold. I drove very slowly, window partly down, head partly outside, scraping snow by hand from the left corner of the windshield, and constantly looking for a white line which taunted us. Barb did similarly out the right window looking for road shoulder and edge. Into the high Rockies we went. I really don’t know what else may have happened. Love obviously conquered all, and we made it safely to our little cottage at 1267 South Emerson. Tired, happy, in love, and largely broke.

## Perdido, South Emerson, Adventures

I went right back to work, to my semi-delinquents, and to DRI. Barb looked more into linguistic studies at CU, learned of their English as a Second Language specialty, and looked for a job. She got one at Joslins in downtown Denver as a shoe saleswoman/secretary. We were not flush, but fine. We made a home, recalling that first date – *West Side Story*:

‘...there’s a place for us.’

We planted the tiny parcel of land surrounding Perdido’s tiny off-alley parking spot, made friends with our neighbor’s two little boys and settled in. Barb discovered a good second-hand store on Larimer St. We acquired a pedal-powered sewing machine and other items.

South Emerson St. was a few blocks from Denver’s large Washington Park. That was the good neighborhood news. To the west of us was an operating component of the Gates Rubber Company – and, when the winds blew our way, we knew it.

There was a market and some shops a few blocks away. My folks visited while we were there. We walked over to one shop to get ice creams for all, especially little brother Manny. Dad helped with some bathroom repairs. We may have gone with them to the Tetons for a few days. We worked, lived, loved.

In mid-summer I went to back Perdido out of his off alley parking nook and he pulled out much of several bean, squash, and other plants that had cuddled into his front bumper. We also farmed a little patch adjacent to the cottage. Barb was and is an avid gardner; we used the little land available to us, perhaps emulating my long ago relatives in the Azores.

We even traveled some. We took trips to Idaho Springs and Loveland Pass just west of Denver and to Estes Park and Rocky Mountain National Park. Once, near Idaho Springs, Colorado, we backpacked in, set up camp, cooked something on our camping gas stove, and spent the night. In the morning, as we were exiting the tent, a somewhat rough looking man appeared and approached – somewhat menacingly.

Barb recalls ‘He had a gun!’.

“What are you doing here?” he asked.

“Just hiking and camping,” I answered.

“You can’t; this is private. You’ll need to go,” he replied, authoritatively.

“This is public land, isn’t it?” I cautiously asked.

“Not anymore. You’re on my mining claim.”

He paused for a second.

Perhaps noting we obviously posed no threat, he said:

“Follow me.”

Barb and I looked at each other, at the man, and at the gun. We complied.

We walked a short distance to his log cabin.

“My wife needs to talk to a woman,” he said. “She’s been lonely up here.”

We walked with him, met his wife, and Barb talked with her. Barb can be a very good listener.

Then we said our goodbyes and left. So much for ‘public’ lands.

In our little excursions into former mining areas and ghost towns, we would find stuff. We still have and use a small glass saltshaker and an aluminum measuring cup, some 50 years later.

On Dec. 15 we entered into a 1 year lease with the Halushchaks for a different tiny cottage – this one at 2250 South Ogden St. – on an alley and much closer to DU – and more private, with lots of land – \$42.50/month! We liked Mr. Halushchak, he liked us.

Feb. 4, 1967, our first wedding anniversary. We had seen and been impressed by a small French restaurant in downtown Denver. We wanted to celebrate our First in style – we splurged. Barb dressed up; so did I. We went marching in to the restaurant. I was promptly informed that I needed a ‘jacket’.

‘We have a dress code,’ he said.

He loaned me a jacket. I complied. In we went.

## Grad School, DRI, DU

I had interviewed with all the metallurgy and materials faculty to find a mentor and thesis research topic. Back at San Jose I was thinking of a one year grad

school effort, maybe going to work overseas with a Masters degree. But having the NSF fellowship meant going for a PhD might be the best decision. I had given a seminar in that last year at SJSU on orthopedic implants – artificial hips, etc. – and became interested in the metals – superalloys – used, for their strength and corrosion resistance. Those materials were used in the fan blades of jet engines. DU had recently hired Jack Newkirk, an expert on such materials. I was a good ‘catch’ because I was ‘self-funded’ via the NSF award. I went with Newkirk and began studying superalloys, but with this latent interest in materials for medical implants.

Jerry Plunket, the department’s local ceramicist, gave a great seminar some months in on ceramics as medical implants – strong, noncorrosive, and often biochemically inert as well. He had heard a talk about artificial hearts, perhaps even by Willem Kolff (more on him later). Plunkett speculated on the use of ceramics in artificial hearts. He was eager, dynamic, charismatic, optimistic – a little crazy – in contrast to Newkirk’s more sedate, cautious, and rigorous persona. Dr. Plunkett and I hit it off. I transferred mentors. Newkirk was hurt and offended, but tried not to show it. We worked a little together later when he became involved in developing a hydrocephalus shunt for his daughter. I officially began studying biomaterials, under Jerry Plunkett. I learned later that Plunkett had some DC connections and was instrumental in getting Federal (pork barrel) dollars for a new DU research building, which I later worked in.

Very early on in my DRI experience I was fascinated by a professor who was also an active metallurgy consultant; he introduced me to punched card literature retrieval. This was even before IBM punched card massive computers and personal computers. Steve Jobs’ pioneering Apple II Plus was still nearly 15 years away.

These were simply large physical cards with 3 layers of holes around their periphery which could be manually punched. A small box of cards punched in a key word topical pattern could be ‘searched’ using a long needle. The cards with the appropriate punches would just fall down and out, presenting the retrieved information. Really cool and effective. He gave me some cards and I played with them.

He would scan the metallurgy journals received by the library, copy the abstracts of papers he wanted, paste or tape the abstracts on the cards. Then when someone called with a consulting question, he would interrogate his punched



card collection via the long needles, and *voilà!* – out would come the cards with the relevant abstracts. I thought it was brilliant – all pre-computers.

The cards were made by E-Z Sort systems in Chicago, and actually available via the American Society for Metals. I joined as a student member.

I learned a half century later in Monterey that John Steinbeck's marine biology friend and co-author (of the *Sea of Cortez*), Ed Ricketts, did the same thing to keep track of his marine biology studies and samples.

Biomaterials was already a very broad field. It would soon have its own journal and society but most of the experience was scattered through small mentions in medical journals and thus difficult to access. So I tried to organize the field for my own efforts and interests. This led to my first paper – an extended abstract – for my first conference, which – as I recall – I was not able to attend. But it was published! – authored by me and Plunkett: *A Medical Materials Literature Classification System*. A concluding sentence: '...useful to the individual investigator who wants to keep abreast of the literature without drowning in it.' I wanted to know – or at least be aware of – everything in the field. That became a passion – an obsession – that characterized my entire career.

## Traveling Together – Time Zones and Grau

Biomaterials was new and expanding rapidly. I wanted to learn the very current work via conferences and workshops. But we were poor, had no grant funds (yet) to help subsidize travel, and were far away in Denver. So we drove. Barb had grown up in what we might today call a frugal and resilient environment. Mine was less frugal, but very resilient as well. We removed Perdido's tiny back seat, acquired an old mattress, cut it to fit the back space. One of us could rest while the other drove. Cute, cozy, practical. We also bought a Sears 1 ½ sleeping bag – one bag for 2 people. Fortunately, Barb is a smallish woman.

Our first large trip, probably, was to Madison, WI for a week-long biomaterials workshop in Fall, 1966. The most developed sub-field of biomaterials at

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the time was dental biomaterials. Dentists have been filling cavities for thousands of years. Dental school had courses and labs on the subject. There was an already classic textbook, *Dental Materials*, whose author was on the program. Barb accompanied me to some workshop dinner where the dental materials guy clipped his nails while someone else talked. Barb was really annoyed by him. She liked watching people, as well as birds and bugs. It was a good workshop for me – providing background, introductions, and perspective.

We then went on to Chicago to visit the Arnows – Barb’s Aunt Edna and cousins – Patty, Michael, and Maureen, and Josephine Goldberg – her dynamic grandmother. I recall the Arnow home in North Chicago, and Edna’s full ceramics studio. She was already a known Chicago potter. The cousins were great. Barb had visited them many years earlier and again with her mom, Le Rose, after returning from the Peace Corps experience. From Chicago we made our way around Lake Michigan and on East to Cleveland.

I had set up a brief meeting with Dr. Harry R Grau, who compiled and published a regular Bibliography of Foreign Substance Implants in Medicine, in the new journal *Transplantation*. Grau was a pathologist. Problems or reactions of ‘foreign bodies’ – slivers, bullets, implants – anything embedded in living tissue – was (and still is) the province of pathologists. We pulled in to a parking lot outside Grau’s office and clinic, just barely on time. I left Barb in the car and ran to the meeting. I finally found Grau’s office – he was talking with someone. I made my presence known, gently. He looked up at me.

“You’re late,” he growled.

“Only 10 minutes,” I said. “Sorry, I’ve come from Chicago”.

“Ever hear of time zones, kid?”

Oops. But he said it with a wry smile. We had been in Madison and Chicago, on Central Standard Time. Cleveland was on Eastern time. I apologized.

“Happens all the time,” he said.

I felt like a medical student getting another verbal bruising from an overconfident specialist.

Grau was gruff, but we hit it off.

“Tell me what you’ve got,” he said.

I congratulated him on the medical implant bibliography, said I thought this new, large field of medical biomaterials needed some topical organization, and that I’d like his input and perspective. Grau had been focused on materials

used in plastic and reconstructive surgery, mainly the silicone materials now readily available, largely inert, and thus becoming widely used. The silicones were made by Dow-Corning Chemicals; they had an information center directed by a Silas Braley in Midland, MI: the Dow Corning Center for Aid to Medical Research. Braley also worked with Grau on his Foreign Substances Bibliography and listings.

Grau listened. I noted orthopedic materials, vascular biomaterials, dental, etc. I briefly presented the preliminary classification system, noted punched card retrieval, suggesting that it might soon be supplanted by computer methods. He agreed, pondered, thought, looked at his colleague who had been with us the whole time.

“You’ve got something, kid,” he said. “You have no idea how important, how big, this could be.”

“Thank you, sir,” I said, and began trying to excuse myself. We’d been talking for over an hour. I explained that my new wife was in the car.

“Better get back to her,” he said. “Keep me informed. I like it.”

He stuck out his hand, I shook it and left. And ran out to find Barb. That was one of the first of the many times she would wait for me. She was indeed resilient – and patient, so far.

It turned out that I didn’t really do anything with Grau, but meeting him and getting his blessing did wonders for my self-confidence and commitment.

We then routed roughly Northeast to Andover, NH. to the first ever Gordon Research Conference on Biomaterials, held at Proctor Academy. On the way, in mid New York state somewhere, Perdido was asked to pull over. The police officer noted the PERDIDO sign, and curiously, the mattress in the back, the Colorado license plate – and noted that I had rolled through a red light. I was a bit addicted to so-called ‘Hollywood stops’ at that time, so I was probably guilty. He gave us a warning as we assured him we were on our way out of town.

Everyone I needed to know and learn from was at this first Gordon Conference. I had managed to get some student discount on the fee and opted out of living with the conferees, largely due to cost concerns. We were really broke. We had found a state park on the VT/NH border roughly 20 miles from Proctor Academy. So we went to Mt. Ascutney State Park and pitched a tent. For the first day or two I would commute to Andover, and Barb stayed in the tent. It rained. Slugs started to move in. She didn’t even have Perdido to escape

to. Quickly I somehow made an arrangement (perhaps debt!) to actually get a room at Procter. We moved into a tiny room, without rain or slugs. Marriage saved. Barb discovered the campus library and had a good time learning about ecology, wildlife, and related areas. I met many important and helpful conferees and some fellow students. The meeting served as a foundation for the field for many years.

On the way back West, I think we routed North via Watkins Glen State Park and then to Ann Arbor to see my old Barrington Hall roommate, Kent Stitzer. We went for a short sail with him and his then wife Maxine, a guitar-strumming folk singer. The trip west, probably along Interstates 86 and 90, included a really intense, dark, heavy rainstorm. After that, we probably just drove as straight and fast as Perdido could manage.

## Residency, Predecki, Library, Vroman

A few months later we moved to 2250 S Ogden: Dec. 15, 1966. Nearly a year later, needing to renew our lease, Mr. Halushchak sheepishly and sadly told us he'd have to raise the rent to \$55/month. We reluctantly and kindly agreed. We liked the place. I set up and continued doing B&W photo processing – probably in the bathroom of the cottage.

It was likely Plunkett's artificial heart – ceramics interest that led me to look at blood coagulation induced by materials. The more I looked, the worse it looked. But the surface-induced activation of a protein to become an enzyme which then started a cascade of reactions was fascinating to me. I knew no biochemistry, nor even any basic organic chemistry.

I took a full year organic chemistry course in DU's summer session – it was grueling. I hated organic chemistry largely because of all of the named reactions. The organic chemist's climb to immortality was to devise a new reaction which would then carry his name forever. Every reaction had a name, hundreds, thousands of names. I even composed a quite long poem (lost) of complaint about

the problem; the professor was amused by it, suggesting I should have used that time to learn the reactions. I then took a synthetic organic course with the same prof, and a course on radiation and radioisotopes, as it was already clear that they would be necessary in my upcoming research. The organic chemistry prof told a tale about a student who spent six months purifying an organic chemical he assumed he'd synthesized. It turned out to be a plasticizer used in plastic tubing, which was used in his chemical apparatus. The process had dissolved/leached it from the tubing; he proceeded to purify it thinking it was his desired product! A good lesson in purity and cleanliness.

I got in touch with Bruce Paton, Chief, Cardiothoracic Surgery, u Colorado medical school; he was willing to advise me in developing a research project related to surface activation of blood coagulation.

Paul Predecki joined the DU-DRI faculty in fall, 1966. He had been working at Dupont in Delaware with William Statton, a pioneer on the structures of polymers. He applied some materials science techniques to the analysis and characterization of polymers. DRI was moving from being a metallurgy-ceramics group to the broader fields of materials, which includes plastics/polymers. Paul filled the gap. By then I realized that plastics were the preferred materials for cardiovascular applications. Plunkett was not that interested nor really available. So Paul inherited me.

Barb was declared a formal Colorado resident in Spring, 1967, qualifying for resident tuition, which we could afford. She entered the University of Colorado (CU) linguistics program, with an emphasis on TESOL – Teaching English as a Second Language. She would commute to Boulder via Perdido along the Denver-Boulder turnpike. Barb was especially impressed by Gladys Doty, one of her CU instructors.

One of her interesting classmates was Shafiq, from Afghanistan. Shafiq had recently met her new fiance, Ahmad, also from Afghanistan. He was doing an internship in photogeology with a Denver firm, on leave from his studies at Wesleyan. Barb and Shafiq became close and dear friends. We attended their Boulder wedding on Feb. 14, 1968. They returned to Afghanistan in fall, 1968. Their first daughter Mary was born Dec. 11, 1968 in Afghanistan.

We had a party at our place in Denver one evening with people speaking languages I'd never heard – and music, some of it reminiscent of my former roommate in Berkeley – the portly one from Iran. Barb's vinyl records of

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Colombian *cumbia* helped set the stage – she loved to dance. I was a dance partner disappointment. The music sparked much discussion. Several Africans said that was their music; the Latinos said, ‘no, that’s from South America’. The middle Easterners had their own perspectives. Interesting.

One of our records was that Amalia Best Hits album I’d acquired in Berkeley. We were and are especially fond of her classic songs *Una Casa Portuguesa* and *Lar Portugese*. We resonated with the lyrics:

*Bebemos do mesmo copo*  
*Comemos do mesmo prato.*

Our kitchen dinnerware was very limited!

Barb and I would take walks around our new abode on S Ogden St. One day in early 1967 we walked through Platt Park some 6–8 blocks away. It contained a delightful, beautiful little library, a local branch of the City of Denver system. We were very fond of libraries. We had met in the *UTC* – Berkeley library. Barb worked in one in high school, and I loved the little Decoto library in my pre-puberty years. Libraries (and swings) were very strong interests. We were just looking it over, browsing.

I entered the children’s section. There was a small wheeled cart, as I recall, with the sign *New Books*. I looked. And – another minor miracle – there was a tiny book titled *Blood*, by a Leo Vroman, a guy with a big nose, via his sketches. It was a kid’s book in a new series from the American Museum of Natural History, 1967. I immediately loved it – we both did. It’s a beautiful story, a mini-autobiography, of his quest to do research related to proteins, blood, and coagulation. Simply and beautifully written and illustrated, it was the most current exposition of the state of understanding of the activation of blood coagulation via surfaces. I checked it out, devoured it, and almost immediately tried to contact Leo Vroman.

The idea that surfaces actually activated a protein to become an enzyme led to the idea of using enzyme inhibitors to inhibit the activation process. I had been taking organic chemistry and reading biochemistry. I’d also learned about the very recent work on attaching active biochemicals onto solid surfaces. Katchalski and his team in Israel had applied new synthetic chemical means to attach proteins and other biochemicals directly onto surfaces – covalently. So

why not attach enzyme inhibitors onto the implant surfaces, thus making the treated surface unable to activate enzymes on or near the surface?

I knew that the NHLBI had developed a program on blood compatible materials, including a new contract-based rapid funding mechanism.

Thanks to Predecki’s encouragement, I wrote a contract application to the NHLBI Artificial Heart Program, probably in early 67. DU submitted it in Predecki’s name as Principal Investigator (PI). We waited. That was probably in early 1967. Some months later we got a phone call, they liked the idea, but could we do it in 1 year rather than 2? We had written a 2 year program, but the agency had some money to allocate before the end of its fiscal year, and asked if we could do the work in 1 year – and they’d fund it all right now! The Denver Research Institute had no experience with such a request. They asked Paul who asked me if we could do it. I naively agreed.

We had a contract with real dollars to help fund the research. We were assigned a lab in the new Materials Research Building, funded via a NASA ‘pork-barrel’ allocation which had been engineered by Plunkett.

## Olsens, Northern Lights, and Stockholm

The enzyme inhibitor hypothesis was submitted as a paper to the ICMBE (International Conference on Medical and Biological Engineering) to be held in Stockholm, Sweden in July, 1967. The abstract was accepted. We were going to Europe! I think the timing was such that I could access some contract funds for the USA legs of my travel. Barb and I scrimped even more and drove to Connecticut to see our friends Dennis and Milly Olsen, likely stopping on the road and sleeping on the custom cut mattress tucked inside Perdido. The Olsens were close friends and became even closer. Dennis and I were classmates at SJSC. They were married in 1964. Barb met them in 1965 when she returned from PCV. We saw them off at Tahoe before we headed to Lake Winnemucca that summer with I&S, T&J.

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We stayed with them in Hartford in August, 1967, just weeks before they moved to Denver – Dennis would be a classmate of mine in the Metallurgy and Materials Department. They took us to Cape Cod, where we camped for one night before taking a boat to Nantucket Island out of Woods Hole. And there we hiked down the main street of the town; there were no room vacancies in town! So we walked out of town, pitched camp, ate a late dinner, and watched the ‘northern lights’. When we woke up in the light of the morning, we discovered we’d camped very close to a private residence. It was drizzling, so we stashed our equipment and hiked to the road.

According to Dennis Olsen’s memory, a nice lady drove us to town and told us that it was illegal to camp on the island. She dropped us at a coffee shop and wished us well. After ‘breakfast’ we bought sandwiches, rented bikes and toured the Atlantic Coastline wearing rain gear. We returned to the stash after dropping the bikes off and skipped town for a very rough ride back to Woods Hole before the authorities could find and fine us the \$50 ticket for illegal camping!

A day or two later we went together to Kennedy airport in NYC, where we parked Perdido. The Olsens then drove with us to NYC for lunch or dinner. Highway traffic in Brooklyn was not moving, so we had a wild drive back across town, running very late. When we were again stuck in traffic – inside the airport – Milly, Barb and I got out and ran to the terminal with our luggage. Dennis parked on the lawn as the lots were full. But then he met us at the gate because all the flights were delayed! We barely made it. We boarded Iberia Air bound for Lisbon. Our seats were across the aisle from each other. We annoyed the attendants by holding hands across the aisle and releasing our handholds slowly to get their attention. They finally arranged to seat us together.

We overnighted a day or two in Lisbon in a small *pensão* right downtown – after a harrowing cab ride from the airport. We were so tired we literally slept until noon the next day. Lisbon was wonderful. We’d be back. On to Madrid where Barb’s PCV partner, Becky, met us with her husband, Jose. They married in Colombia and then went to Spain – another cool love story.

They introduced us to tapas, directed us to Toledo, and much more.

We then made our way to Stockholm, probably via Paris or Amsterdam, to the ICMBE conference. Upon arrival we needed a meal, went to a diner-like place and bought the spaghetti dish (we were still broke). It’s been a private joke ever since: Never order Swedish spaghetti. Earlier we had arranged the



most inexpensive conference accommodations – with a local family with young, noisy daughters.

Barb explored downtown Stockholm, which she found colorless and dull after nearly two years in Colombia, South America. Barb recalls all these tall people (she’s 5 foot two) and tall service counters. She had to arch her head up to see and talk with most Stockholmers.

I attended the conference and presented my paper. I ran into Don Lyman on the street. Lyman was a polymer chemist, working at Stanford Research Institute (SRI) on polyether urethanes for blood-contact applications. I was aware of his work. He showed me a slide of the work he would be presenting. It showed a protein molecule reclining, well attached, on a surface. I thought it was incredible – beautiful to actually ‘see’ an adsorbed protein. I wanted to understand much more.

We came back to NYC, retrieved Perdido, and headed home. I don’t recall the trip home. I do recall arriving late, very tired, driving in from Kansas or Nebraska, and going straight to bed.

Meanwhile the Olsens had packed a moving van and then took a two week drive through Washington, DC, West Virginia, Ohio, and St. Louis on their way to Denver, arriving early September 1967.

## Here comes Tonio!

The South Ogden cottage was very comfortable. There was a back bedroom, near the alley, encased on the south side with foliage. It had a depression on the floor – a hole covered with a thin metal sheet. We weren’t curious enough to investigate. We had a fairly large living room with a couch on the east side and a single bed used as a couch on the north side. Perdido’s home was in the driveway, off the alley, just to the north of the cottage. We had radio, speakers, perhaps record player. We think Tonio was conceived on the bed/couch during a full moon in late Fall, 1967, Perdido resting quietly nearby. We would read to each other occasionally. I remember *All Creatures Great and Small* (long before the PBS TV series) and *The Hobbit*.

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We had purchased, perhaps even been given, a large second hand rug, so we cut it and put rug everywhere, even in most of the small bathroom. The stove was very old, gas, but with a side section suitable for wood burning. There was a tiny basement with very narrow stairs from outside – where the water heater and boiler were placed.

Barb's Peruvian *sapo* (frog) game was in the corner of the living room. Sapo was a metal toss game, a colored box with holes in it representing points. Barb saw it played in Colombia. On a PCV excursion trip to Lima, Peru she saw it in a shop, purchased a set of components, and carried it home. It became part of her 'dowry'. There was a cool metal frog with an open mouth. The idea was to toss the coin (actually a large metallic disc) into sapo's mouth. There was also a propeller-like structure over one of the holes. Hitting it made a strong metallic clinking sound and it spun around. Cute and cool. She had brought the pieces from Colombia and a sketch of the game box. I surprised her, perhaps for Christmas, 1967, with the complete game. I made the game box in my DRI office secretly – sawing, painting, mounting, and placed it in the living room. She painted flower decorations on the back and sides of the game box. We installed a bell to ring whenever the Frog or the propeller got properly hit. She was very pleased; we played fairly often.

Dennis began work at DU towards his PhD. I now had a colleague-friend and Barb and Milly became even greater friends. We four went hiking and camping together, including wild blueberry sourdough pancakes at over 9,000 feet near Longs Peak, just south of Rocky Mountain National Park. Barb and I slept with her bag of sourdough in that Sears 1 ½ sleeping bag. The sour dough expanded greatly during the night and was used, together with Milly's freshly picked wild blueberries, to make the best blueberry pancakes we ever had.

We lived just a few blocks apart in Denver. Den and Mil had a tandem 2 person bicycle they would ride to our place. We cooked and ate together. One time Milly showed us a demonstration of the Portuguese in Hawaii. Portuguese had a strong presence in Hawaii and Japan, a result of the old voyages of discovery and colonialization. She took a bowl of water and sprinkled pepper powder on the top. The particles represented Hawaiians in the water. She took a toothpick with a bit of oil on the tip (these were the Portuguese) and touched the water surface. As the Portuguese entered the water, everyone else rushed out of

the water toward the beach! A good ethnic joke, not very PC in today’s environment. The demo served me well in later surface science courses!

## Research, Vroman, Albumin

I presented a mid-year progress report on the contract project in Dec. 1967 at the NHLBI Contractors meeting in DC. Don Lyman also presented on his work, so we had the opportunity to followup on our discussions in Stockholm.

Vroman was contacted and was interested in our work. We asked him to serve as a consultant on the new contract. We also asked him to serve on my PhD supervisory committee. He agreed. In response to a question on blood compatible surfaces, Vroman answered with a simple, very important observation and suggestion:

“Well,” he said, “albumin is the most common protein in blood, so it’s obviously blood ‘compatible’.”

Yes, indeed.

That became the ‘albumin hypothesis’ and the rationale for attaching albumin to the surfaces of blood-contacting implants. We rapidly modified our contract objectives and worked on what we called albumination. The work on enzyme inhibition was phased out. We also, initially thanks to Lyman’s surface energy ideas, began learning and understanding the nature of surfaces and interfaces in water and in blood. We also had to measure and characterize the surfaces we prepared, using sensitive surface chemistry techniques. It was a good foundation for a career on interfacial aspects of biomedical materials. Paul and I hired a Masters student in Chemistry to do the synthesis work, advised a bit by my former organic chemistry instructor. I was supervising a graduate student while being one. Good experience (for me).

Paul’s girlfriend, Dorie, was (I think) a medical technician; she aided us with our evening blood contact studies. As I recall Paul and I were Dorie’s donors. We biochemically modified polystyrene test tubes and measured blood coagulation times as a function of surface modification. We detected the surface

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modification by contact angle or water wettability measurements via test tube meniscus observations. Barb helped with those studies.

There was great interest in the protein biochemistry field at the time in the covalent immobilization of proteins, especially enzymes, onto various solid surfaces – for a wide range of potential applications. There were many chemical reaction methods by which to bind or tether proteins to appropriately activated surfaces. I reviewed and applied the work of Katchalski and coworkers at the Weizmann Institute in Israel on immobilized enzymes, as well as that of many other researchers.

Irving N Einhorn ran a large set of summer short courses called the Polymer Conference Series. We helped him conduct one called the Denver Conference on Biomedical Materials in July, 1968 at the University of Denver. I think Don Lyman spoke. My talk was called the Chemical Properties of Solids.

Leo Vroman was another participant. Barb and I took Leo to Rocky Mountain National Park. We recall him on his knees at the side of a small icy stream, carefully examining and photographing the ice crystals at the edges of the stream.

## Chinook, Rh, Tonio

Barb often traveled to Boulder with another commuter classmate or two. She also commuted in a now more well worn Perdido, who was beginning to show his age. His bumper had rusted and fatigued itself so badly that we had installed a wooden bumper.

We had heavy schedules in Spring, 1968. Barb was finishing her TESOL studies and was pregnant with Tonio. Perdido had been put down due to becoming unreliable. We exchanged him for a vw van; we were already considering our plans to finish school and get real jobs in 1969. I don't know how we afforded it. We didn't have it long.

Late in Spring term, in May, 1968, 7 months pregnant with Tonio, Barb was driving alone on the Denver-Boulder turnpike. Near Boulder the new vw Kombi van got hit by a strong Chinook wind, flipped, perhaps rolled once, and

ended upright at the edge of the road. Barb was shaken, mildly bruised but otherwise apparently fine. Ahmad Arsalan says there was a notice and picture in the Boulder newspaper, but I couldn't find it. Shafiqa recalls that she and Barb would often commute together between Denver and Boulder, as they had classes and schedules in common. That morning Shafiqa says she decided not to go to Boulder, due to winds being forecast! The vw van was declared totaled; we were without a car.

Barb and Shafiqa (then Nuristani, now Arsalan) finished their studies. Barb's new MA degree is dated June 7, 1968. The Arsalans returned to Afghanistan. It took 12 years to see them again.

My folks visited shortly after the van rolled and totaled itself. Dad and Uncle Manuel serenaded us with their Portuguese guitars. Dad carried a small motorcycle with them on the camper. Erma took very pregnant Barb for a very short motorcycle ride.

Uncle Manuel had a friend, Mr. Olivera, who played Portuguese guitar. He taught Manuel, and my Dad, 12 string Portuguese guitar. They bought guitars, learned by ear, and played with enthusiasm. I remember how much they liked Amalia Rodrigues, the famous Portuguese fado singer, and her guitar accompanists.

The night of July 6, still wheelless, we walked to visit some friends who lived near my DRI office. He was a fellow grad student. They had one child, only one they agreed, and gave us a large set of baby clothes and a small, white bassinet, with wheels. We loaded the bassinet with their gifts. We were now well equipped, happy they only wanted one child. We thought we might want two (only two; Ehrlich's *Population Bomb* did influence us!). I pushed the full bassinet back the half mile or so to our place, Barb waddling her large torso. We made it, went to bed, and then Tonio wanted out.

I called the Olsens. Dennis and Milly Olsen provided transport assistance to deliver Barb to our nearby Porter Hospital. Tonio was born at about 7 am, 7th day of the 7th month. We didn't have a final name for Tonio. The Hospital wouldn't discharge Barb and the new baby without a name – we settled on Tonio Adam. He was named Tonio for an old wise man and friend from Colombia (Antonio), Adam for being the first born.

After we had learned Barb was pregnant we began to select an obstetrician and to study Rh issues. We learned that there was a treatment using an Rh

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antibody – the drug would be called RhoGAM and it was pending FDA approval. We looked into getting access to it. Fortunately, it had been approved – in Feb. 1968, well before Tonio’s due date. Our doctor was older and experienced, but skeptical. He said something like:

“We don’t worry about it. If the kid comes out blue, we give him a transfusion.”

That was disconcerting. Fortunately he was off the day Tonio was born. Tonio was delivered by a doctor and in a hospital that was not so biochemically skeptical. Barb got her RhoGAM shot in case we had a number 2 later; we did.

In mid-July we bought an Opel Kadett red station wagon. It later served to get us to Salt Lake and beyond.

Barb’s Peace Corps partner, Rebecca (Becky) Rabanal was living with Jose, her husband, in Granby, Colorado in the late 60s. Becky suggested to her former college classmate, Karen Sweeney, to pay us a visit. Karen and Bob, a geologist, were living and working in Boulder at the time. Karen did visit about the time Tonio was born. Karen and Bob Sweeney became close, life-long friends. They relocated to Salt Lake 1973–75. We did many family trips together, including visiting them during their stay in Lewes, England in July, 1984.

## Surface Science, Dissertation, and PhD

My surface and interface science interests were stimulated partly by David Crimmin’s new surface science course. Crimmins had been a classmate of Paul Predecki’s at MIT and had recently joined DU and DRI. The rigorous textbook Crimmins used dealt with the thermodynamics of interfaces, as well as the mechanisms of intermolecular forces: Defay and Prigogine’s *Surface Tension and Adsorption*, 1966. It was my first serious and rigorous exposure to the science and literature of surfaces and interfaces. Crimmins liked math, models, and thermodynamics – and I am forever grateful. I became fully fascinated with

surfaces and interfaces, acquiring and devouring nearly all the books I could find and buy on the subject.

I was also fascinated by the ability to estimate and model interfacial interactions, even potentially for proteins. A decade later *The Principles of Protein Structure* by Schulz and Shirmer, 1979, would serve as the basis of my ongoing protein education.

We redirected my PhD work to the subject of protein adsorption at interfaces. I learned all I could about secondary forces, hydrophobic interactions, protein structure, and the math modeling of protein interactions. There were books and papers everywhere. Barb was busy with Tonio and sort of tolerated my mental absence and obsession.

I had access to a real computer, still a bit rare at the time, a PDP-something made by DEC (Digital Equipment Corp.), which used IBM punched cards for programming and data entry. I used the new enhanced Basic programming language, I think called Dartmouth BASIC. The computer was located in the DRI or Physics building and available to me only in the evening. I worked and wrote right through Christmas and until we left for Utah on about New Year’s eve, 1968. A draft dissertation was finished and given to Paul: Coagulation-Resistant Surfaces and a Mechanistic Model of Protein Adsorption on Polymer Surfaces. The original draft had a typo on the cover: dissertation was spelled disertation. Really. I was ready to move on.

I defended the final version on Jan. 31, 1969. Hagel, a member of my committee and Chair of the Department, wasn’t very interested. He was an old school (‘heat and beat’) metallurgist. He said something like:

“New theories and models require caution. Validation and results are imperative. So many new approaches are later shown to be incorrect and invalid.”

So much, again, for my self-confidence. But in the end they all voted ‘Pass’. I was almost finished.

Paul kindly completed the final report on the NHLBI contract. I talked DU and the Department into letting me use Portuguese for my second ‘technical’ foreign language requirement, barely. I was even worse at French, but they passed me, barely.

I was formally finished and degreed, but the formal diploma would be dated June 10, 1969. I was now Dr. Joe.

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Thank you, DU/DRI, Mrs. Patania, Leo Vroman, Paul Predecki, and Denver, where we finally committed to each other, Barb acquired an MA and an Mrs, and I became a husband and a PhD – and we had a Tonio.

On to Utah...



# Getting to Utah – and Staying!

*A Job Offer! • Going to Utah • Tech Travels • Houston and the Moon •  
Utah? Yes • Here Comes Aaron! • Highland Drive • Barb and the Boys •  
Entrepreneuring and Kolff – and Kopp • Balls – The Pim Kolff Story •  
Our Little Acre*

## A Job Offer!

1968 – time to find a real job. My thesis work was at the stage where I could write a PhD dissertation, defend, and leave the University of Denver (DU). Also my National Science Foundation three year graduate fellowship was ending and the NHLBI contract was largely completed. Barbara had finished her studies. We had Tonio to love, nurture – and support. So Barbara and I started ‘looking’.

The economy was not robust in 1968. There were stories of newly minted PhD’s having to be cab drivers in Los Angeles, even those with science and engineering degrees. I was considering a post doctoral appointment somewhere in Texas, another in Michigan. We inquired as to teaching together in a small

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mountain college, including Colorado Alpine College in Steamboat Springs and Ft. Lewis College in Durango.

My father's David Crimmins, one of my teachers, had also been looking. He had just returned from a visit to the University of Utah, in Salt Lake City. He told me that Utah was expanding its engineering programs, including establishing a program in Materials Science. I knew that artificial organs pioneer Willem Kolff had just relocated to Utah from the Cleveland Clinic, and was setting up a bioengineering research program focused on artificial internal organs – especially hearts and kidneys. Perfect, I thought.

So in May, 1968 I wrote to Max Williams, Utah's relatively new Dean of Engineering, and to Willem Kolff, Department of Surgery and Director of Utah's new Institute of Biomedical Engineering. I suggested they could use a 'connector' faculty member, with one foot in Materials Science and Engineering, and the other in Bioengineering/Artificial Organs. I did not know that Kolff had been visiting Engineering faculty, 'recruiting' them to work on his artificial organ ideas and projects. The timing was perfect.

I submitted a formal application and requested recommendation letters from Don Lyman, Silas Braley, and Paul Predecki, which were apparently received and effective. In mid-June Kolff wrote that he'd just had an artificial kidney contract funded, which would permit him to offer me a position. He suggested we visit Salt Lake City for an interview. Barb was fully pregnant, I was very busy, so we agreed to plan for mid-August. Tonio and Barb cooperated, as Tonio arrived safely at 7 am on July 7 (7-7-7!)

Barbara and I packed up our brand new first born and drove our Opel Kadett to Utah in August, 1968. We drove U.S. 40 via Steamboat Springs and Craig, Colorado. Hugh Barber, an old parachuting buddy (we jumped together in Hollister, California when I was at San Jose State), was living and working that summer in Craig. We stayed with him that first evening. The next morning as we were headed out, we discovered a bad tire. Hugh diagnosed the problem by running alongside the car listening for the noise we were hearing. He saw our cheaply recapped tire delaminating! We managed to buy a used tire in Craig before rolling on west.

We recall driving down Parley's Canyon on Interstate 80 into the Salt Lake Valley.

Kolff had arranged for us to stay at Brighton's Mount Majestic Lodge, then a small motel adjacent to a small family-style ski lodge. He 'arranged' this because it was free for him. He had met Mrs. Howard, the owner-manager, likely talked her ear off, and – as he so often did – got her to support his important work – in her case by providing free rooms for his visitors.

Kolff sometimes would fly first class for invited talks and discussions. Although very frugal, he reasoned that it provided him with a greater opportunity to encounter – and talk the ears off – moneyed cabinmates.

We drove up Big Cottonwood Canyon to Brighton (the end of the road) and checked in. It is a strikingly beautiful, majestic, high mountain place – about 8700 feet elevation. The mountains surrounding the area reached up to 10,000 feet. Spectacular. The next morning, a Sunday as I recall, as we prepared to leave for our visit to Salt Lake City, we discovered a dusting of snow all over. It was incredibly beautiful – magical. We were obviously in the mood to accept any offer, no matter how low or marginal! We checked out the city. Downtown was quiet, almost 'dead'. It reminded me of the town scene in the film and book *The Andromeda Strain*. We started to ponder the mountains versus the city.

The next day, Monday, August 19, 1968, I had meetings with Kolff and coworkers and participated in the legendary 'Morning Conference', prepared to give a real talk, but was told to talk no more than 5 minutes. Kolff concluded the half hour daily conference with his standard 'What do you need? How can I help?' He was always in a hurry for all to get things done – no excuses. I didn't realize then the impact of Morning Conference on my own career and behavior as a researcher and mentor.

I also met with faculty in Engineering, giving a seminar on my biomaterials interfaces thesis work. As the Materials group was looking for a new person in the polymers-plastics area, I emphasized work on plastic surface chemistry and structure, which seemed to be well received. I interacted with Richard Boyd and with Abraham Sosin, and met Dean Max Williams.

Meanwhile Barb was caring for 1 month old Tonio, discovered Liberty Park, but felt uncomfortable nursing Tonio in a public space. She ended up going back to Building 512, the temporary building housing Kolff's Division of Artificial Organs (where she had dropped me off earlier). Kolff's office manager, Mary Johnson, found her a place where she could nurse.

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The discussions must have gone well. Kolff really liked that I had written and obtained funding via an NHLBI contract. I was later sent an offer on Kolff's letterhead and stationary. We discussed and negotiated the split with Engineering. Kolff liked total commitment, so he wanted most of me. I wanted a 50–50 split, and Engineering agreed. Kolff said OK.

Discussing our collective future, Barb and I were concerned about living in Utah. We'd heard many stories about the largely Mormon, patriarchal society and highly conservative politics. We thought we'd give it a try, perhaps stay two or three years, and move on.

Kolff and Al Sosin, Director of the new Materials Science program, came through with a written, formal offer – a 50:50 appointment at an annual 9 month 'academic' salary of \$9,000, split equally between Engineering and Artificial Organs. Kolff explained that I would work for him fulltime in the summer, for an additional \$3000. The letter noted the UU retirement benefits, which meant little to us at the time, but indeed provided for a very comfortable retirement a half-century later!

We accepted! We now had the Tonio, the mountains, Kolff, and a real job offer! Allelulia.

## Going to Utah

The dissertation took longer than we planned.

Finally, in very late December, we set out for Salt Lake City with an overloaded Opel Kadett, 6 month old Tonio in a foam-lined box in the back, and garden tools oriented vertically strapped to the car. We left much of our stuff with Dennis Olsen, now a DU graduate student and old friend, in my now vacant office at DRI.

Barbara and I don't recall any details of that winter drive out, so it must have been rather uneventful. Upon arrival in SLC on New Year's Day, 1969, we stayed a night or two in a very cheap motel, on State St., as we recall. We were worried about the gas heater and spent the cold night with a window open. We immediately looked for a house to rent. We found 755 Elizabeth St., near East

High School and close to the U of U. I do not recall how we managed to pay the initial rent and deposit, as we were fully broke and in debt. We probably got an advance on my first check, roughly a month away, perhaps via the UU Credit Union. The house was empty. We used an old instrument packing crate from Denver as a table (the crate had been strapped to the top of the Opel, filled with our stuff). Finally, after that first pay check, we bought a mattress and some garage sale furniture, including a crib for Tonio, who had been curled up in his free bassinet for too long!

We went back to Denver for my language tests and dissertation defense on Jan. 31. I passed and became a certified PhD. About Feb. 2 Barb and I loaded the Opel with much of the stuff we had stored with the Olsens. We drove back to Salt Lake for our first wedding anniversary, and we focused on us, Tonio, and my new career.

Kolff immediately put me to work. I was assigned to ‘calf-sit’, together with all other Kolff staffers. More on that unique part of my by Kolff job description in the next chapter.

On Jan. 14, 1969 UU President James Fletcher officially informed me that I was now ‘Assistant Professor of Materials Engineering in Mechanical Engineering and Research Instructor in Surgery, effective January 1, 1969’. My dual position was with the new Division of Materials Science and Engineering, reporting to Al Sosin, the Director; and with the Division of Artificial Organs, reporting to Willem Kolff, its Director.

I learned that Don Lyman was looking for an academic position. Sosin and I briefly discussed Lyman. He was invited to interview, I think in the Spring of 1969. That apparently went well, as he accepted a full professor position in MSE and arrived in summer or fall, 1969. In the meantime I had hired David Malm, who I think had already been working a bit with Kolff, as sort of a Man Friday. I soon hired Rick Van Wagenen, who was finishing an undergrad degree in Mechanical Engineering at the time. They were likely hired via Kolff-derived dollars, as I had no grant nor any ‘start-up’ funds.

## Tech Travels

In April, 1969 we went to Chicago for an American Chemical Society (ACS) meeting. We stayed with Barb's Aunt Edna. Ten month old Tonio met the relatives and, Barb recalls, promptly snuggled into Barb's grandmother, Josephine's, ample bosom. Don Lyman's work had generated media interest, as did his pending relocation to the University of Utah. We were together with a reporter who was offering drinks – she said something like:

“I understand when you Utah boys get loose, the drinks flow.”

I probably imbibed, as did Lyman.

We drove on to the 1969 ASAIO meeting in Atlantic City. Barb and Tonio experienced the beach and famous boardwalk. I probably visited Sam Ronel and HydroMed Sciences while in New Jersey, as they were the USA representatives for the hydrogel work from the Prague Institute for Macromolecular Chemistry (IMC).

Then on to Brooklyn, crossing the Verrazano-Narrows Bridge, and to Vroman's Lab in the Brooklyn VA, practically under the bridge. Leo was great. He demonstrated his unique methods and techniques, several which I later used in my own work. He introduced me to the ellipsometer, a very sensitive, not well known, and thus hardly used optical method to study interfaces. He had described it beautifully in his little classic *Blood*, which helped launch my interest and career. Vroman was a great sketcher and poet and an exceptionally clear writer.

He took us to his apartment, where we met Tineke, his wife, which we'd been introduced to via his writing of her in *Blood*. Barb and Tineke really enjoyed each other. We talked about Leo's *Blood* book, and its role in my work and budding career. He demonstrated his novel, yet very simple, methods for 'seeing' and measuring proteins at interfaces and for the characterization of surfaces. I returned with a set of notes which were later included in a summary report by Randy Lee for our MSE 792 course on Materials Science in Biological Systems. We titled the brief report Langmuir-Vroman Techniques. I was already familiar with some of the Langmuir methods (Irving Langmuir was a very respected, well known, Nobelist surface chemist who died in 1959) from my own studies,

and also via the work of Robert Baier, whose work I knew and appreciated. I stayed in touch with Vroman until his death in Texas at the age of 98.

Randy was employed by Sung Wan Kim to work on protein adsorption and platelet adhesion. Carolee Adamson was in my lab, also an undergraduate, working on my group's protein adsorption work. They bonded – literally, becoming Mr. and Mrs. Lee. Randy went on to medical school and Carolee later ended up as a key administrator for OMSI (a science center) in Portland, OR.

We may have returned via Columbus, Ohio and the Battelle Memorial Institute, for a short visit with and tutorial from Richard Falb, who had been working on immobilizing the anti-coagulant heparin onto surfaces.

## Houston and the Moon

That summer of 1969 we set off in mid-June for Houston, for me to participate in a unique six-week course at Baylor College of Medicine: Classical Physiology with Modern Instrumentation.

We had a small apartment in a complex that had a pool, common in Houston's very hot, ultra-muggy summer weather (and that was well before major climate change).

I learned about the dew point, the temperature at which water condenses. Houston's air was often in the high nineties, for both temperature and relative humidity. Under those conditions, the dew point can be just below the surrounding temperature. So when you leave an air-conditioned building, water condenses on you, all over you, almost immediately! Interesting – and very uncomfortable.

Barb entertained and supervised Tonio, now nearly one year old. He enjoyed crawling around chasing roaches, and even trying to taste a large semi-tropical insect (Barb pulled it from his eager mouth). We met up with Risto and Marjatta Collan, with their daughters and young boy Jussi. Jussi and Tonio were able to play and communicate in pre-English – pre-Finnish! Risto is a Finnish anesthesiologist and was working a year with Kolff; he was also a course attendee.

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The course was terrific. I'd had no exposure to physiology – nor even biology – since high school days (when dissecting an egg-filled frog turned me away from Biology!). Les Geddes and Hebbel Hoff were very colorful, charismatic, entertaining, and effective instructors. Each participant was part of a several person team with a physiograph – a relatively new multi-channel sensing and recording system. This allowed several variables to be monitored and displayed/recorded in real time! Quite 'revolutionary', really. I learned a lot. Then back to Utah, probably via Denver to see the Olsens and pick up the rest of our still stored stuff.

On the way home Tonio discovered the moon – the *luna*. Barb and I remember a unique moon experience on the way back, probably in Western Colorado or Eastern Utah:

We were driving West on July 20, in the dark around 8:30 pm, probably on us 40 somewhere rural but around Grand Junction. We stopped for gas. The attendant was in his small space watching a small tv. I came in to pay and he said "Sshhh!" I saw Neil Armstrong's leg exiting the first Moon module! I ran to the car,

"Barb!" I hollered and tapped on the window.

She came out, and we watched the first human contact with the Moon. Incredible. And since then Tonio, and Barb – and I – have had a special connection with el Luna.

On to Utah, where we had a rented house, a good job, a pleasant environment, and a used crib. Life was good.

## Utah? Yes!

The University and the Wasatch Mountains captured us. We love the mountains. We would hike all over. Cecret Lake in Albion Basin, at the base of Sugarloaf Mountain, was a special attraction and destination: the beautiful lake at 10,000 ft, Sugarloaf looming over it at nearly 11,000 feet, the wildflowers of Albion Basin, and the ski town of Alta. Paradise. There was one time when I walked from Sugarloaf towards Devils Castle, with Tonio on my back, not sure



exactly when, and we semi-‘skied’ down the scree field above Cecret lake. A bit stupid, as I could have fallen and dumped Tonio. We survived – and the kids have been good hikers ever since.

The Mormons had been friendly and supportive and so had the University. We decided to stay.

## Here comes Aaron!

We were comfortable renting the Elizabeth St house – we had a one year lease. Our phone number was probably 355-8728. Barb was working via doing Spanish translations from home.

We began thinking of buying a house and providing a playmate for Tonio. We began casually looking at possible areas and houses, knowing we couldn’t afford to do anything that first year. We wanted land to grow stuff. The Denver Ogden St. cottage set an expectation. So much land – so much opportunity for gardening.

In Fall, 1969, probably with my first-check, on the newly purchased mattress, Aaron was conceived during another full moon. Barb was – and still is – affected by full moons. Back then she became more interested in nocturnal activities – in more recent years she just can’t sleep. Suddenly our house hunting became more focused.

We looked at perhaps a dozen or so homes in different areas, mostly with substantive plots of land. We saw places with chicken coops, sheds, even a barn. We weren’t looking for a lot of land, but more than a small city lot. So we ventured south. We were still largely broke but now had a credit rating, a bank account, and a credit union to maybe help. Our realtor, we think Marilyn Waring, knew of a semi-rural home just coming on the market. The house was much farther south than we wanted. We visited and toured it and the 1.2 acre property: 6009 Highland Dr. It had 2 bedrooms, 1 ½ baths, a carport, and a dramatic view of Mt. Olympus and the Wasatch Mountain range.

The front door opened into a large living room with a high ceiling and large windows oriented east and south. The Wasatch Mountains were right

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there – dominated by Mt. Olympus. It was beautiful. Light filled the space. We were nearly sold then and there. It had a very functional kitchen and layout – all for \$20,000. The owner-sellers were Dr. Paul Porter and his wife; he was a professor of psychology, nearing retirement. He wanted a 10% down payment and was willing to carry the contract. Wow. It came with two shares of irrigation water, from the Big Cottonwood – Tanner Ditch Company. There were several such irrigation water organizations in the Salt Lake Valley – they served the irrigation and watering needs of the originally rural farming community.

We did not have \$2,000. I talked with the utu Credit Union; we were already members and auto-withholding some of my salary into one of their savings accounts. We came up with the plan of using the two water shares, valued at about \$1000 each, as collateral for a \$2000 loan – to use as the down payment. Another miracle! Paul agreed to sign over the shares for us to use as collateral. Amazingly, it worked. We got the \$2000. Paul got his down payment. We used our payroll deduction to pay the loan, we kept the water shares, and Paul carried the contract. The whole thing was just a bit better than a house of cards! We were now home and land ‘owners’ with two new debts – and child number 2 on the way.

We had accumulated some used furniture during 1969, so I rented a truck. We loaded it, drove south, missed a turn, so I turned the truck around via someone’s semi-circular front driveway. I nearly ripped out their power line due to the high clearance required by the truck. Fortunately, no power outage or electrocution.

We drove up our relatively long rural driveway, drove across the back lawn, close to the house’s ‘front’ door, and began to unload. We noticed after I returned the truck that I’d driven over a sweet one foot tall, though now well bent over, oak tree. It survived and grew, was transplanted to our 1997 home, and now stands nearly 50 feet tall. The Porters informed us that they’d grown the tiny tree from an acorn they found during a visit to England.

Later, while or after I’d served on the utu Faculty Research Committee, one of our grantees, Walter P. “Doc” Cottam, had starts of hybrid oaks. He was trying to develop an ‘evergreen’ oak. He gave starts to committee members interested in planting and observing his hybrids. I accepted three, Barb planted and cared for them, but they didn’t do very well, she recalls. She knew Cottam

through his involvement in the UNSS – the Utah Nature Study Society. He was also the founder of the UU’s Red Butte Garden.

The 6009 property was between a large Mormon-LDS church parking lot and ball field and a kindly ex-Bishop Mazel and his wife Melda – the Neilsen’s. They became great neighbors. Mazel was an avid and very productive gardener/farmer. Back in 1969–70 they had a cow in the back. Mr. Neilsen was very experienced and knowledgeable with the irrigation process – the weekly schedule, the various gates and diversions to deliver and direct the water, and the details of getting the water directly to where it would be the most useful. I had studied a bit of fluid mechanics in undergrad engineering, but this was real hydraulics!

Mazel came over often during harvest season with armfuls of produce and fruit for us. Barb recalls the near-neighbors just south of Nielsens – the Marchants – bringing a box of apples to us shortly after we moved in – just to say hello and welcome. Mazel had a small walk-along tractor, like a very large roto-tiller. He’d mount a snowplow on it in the winter and would often plow our front sidewalk, paths and even driveway. What a guy!

Barb and I were into sustainability and self-reliance. She grew up on a farm, with cows in her very early days, picking prunes in her teen years. I grew up doing yard and garden work, and picking and slicing apricots for drying. We enjoyed gardening. So we tilled, spaded, planted, watered, and grew. We had a very large garden. We tended our long neglected orchard containing pear, apple, and apricot trees, as well as grape vines. I learned how to prune and how to irrigate. And we raised and ‘processed’ rabbits for a time. We coveted a smaller version of a walk along tractor, decided on a Troy-bilt roto-tiller, and saved for a year or so until we could actually get one. It was our mainstay farming tool until we moved, some 30 years later, to a much smaller space with no need for a roto-tiller/tractor.

About six months after we moved to 6009 Highland Drive and a week or so before Aaron appeared, Le Rose, Barb’s Mom, came to help out – before, during, and after his birth. We took Le on a tour of the local mountains, including Provo Canyon. I had heard of a great drive, heading south along the west Wasatch foothills, called as I recall Squaw Peak Road. We drove... and drove... and drove. Up and up on a good but graded road. We all got nervous. What if Aaron became impatient? It was a beautiful ride with spectacular views. We all survived, pre-Aaron behaved. He was actually nameless at the time.

## Obrigado Pela Vida

At about 5 am on June 20 Barb started feeling contractions. We all went to the UU Hospital. Tonio wasn't allowed near the delivery area, so he and I waited in the parking lot. Aaron was born about 11 am. All was well, but we hadn't decided on a name yet. We had this book of boys' names we had studied. But, after his birth, Barb thought 'Aaron' sounded good and he seemed pleased with the sound – so #2 became Aaron Andrade. We also joked that would put him first in line for nearly everything!

I recall being with Tonio and looking up at the window of Barb's delivery room – she could also see us. She shared the room with a Sylvia Westphal, who was having her second child. They connected, partly via Spanish, and they became good friends. Aaron and Tonio later played with the Westphal kids – Ilse, Francisco, and Ingrid – at our place on Highland Drive while Barb and I talked with Sylvia and Mario. Aaron inherited Tonio's bassinet and later his crib. Tonio was curious but tolerant of our new addition. They were two years apart, close enough to become friends and playmates.

## Highland Drive

It was a very hot summer. I bought and installed a window air conditioner so Barb, Le, and baby Aaron might be a bit more comfortable. Some months later that air conditioner 'bit' me during a Public Service Commission (PSC) hearing related to Utah CLEAR – Concerned about Limited Energy and Air Resources – a small Utah citizens group focused on education and awareness of energy development in Southern Utah. The local coal-focused electrical power company, Utah Power and Light (UPL), was arguing for a rate increase to help fund demand and growth; I was one of several to testify against the rate increase and the demand/growth scenarios. Their slick semi-charismatic lawyer then showed and discussed our UPL bills, informing the commission that over the past year our bills significantly increased – nice work on my conservation credibility.

Obviously, he surmised, UPL was just trying to serve our 'needs' – Joe Andrade must just be a spoiled hypocrite, he hinted. I attempted to explain,

to no avail. They likely got the increase, although the action did help build and energize Utah CLEAR – and me.

Our little acre was a great place to raise kids and practice sustainability. Barb began gardening that first spring. The property was about 100 feet wide, facing Highland Drive, and over 600 feet deep, with the orchard in the ‘far back’. A rustic driveway ran from Highland some 500 feet towards the back. We built sand boxes, hauling sand from a natural dune adjacent to the road several miles south of us. We built swings and a large playhouse with a ladder and a slide.

One very hot summer, when the kids were perhaps 3 and 5, a new friend, Barbara Ross, and her two little girls, also about 3 and 5, came over. Barb & Barbara were gardening in the far back. The kids took care of themselves playing in the new sandbox with water from a hose near the house. It was very hot, so they did naturally what you do in the heat with water and sand. Two very adult women came in the yard looking for the new residents. Barb walked over to them and the playing kids. One matronly woman looked at the nude, wet kids, looked at Barb, and inquired of her LDS ‘missionary’ partner:

“Isn’t that sweet?”

They never returned.

Highland Drive was a very busy street – even back then a major N-S artery for Salt Lake City. We had to keep the kids away from the busy street. So we built a picket-like fence, with a gate to permit the Opel to enter.

The ½ bath in our master bedroom was also used as my little darkroom. It did remind me of the outhouse ‘darkroom’ I used as a child photographer. I continued to do B&W photo processing for a short time, without having to worry to check for black widow spiders first! I do recall a cool poster on the inside door, I think a gift from one of Barb’s friends, with a Navajo prayer:

*Now I walk in beauty*

*Beauty is before me*

*Beauty is behind me*

*Above and below me*

We taught the kids to do yard work, gardening, mow lawns, run a roto-tiller, pile and tie brush bundles. They often did not appreciate their unique outdoor experiences.

## Obrigado Pela Vida

In 1978 we felt financially secure enough to expand our home westward via two more bedrooms and a 2 car garage – thanks to Lynn Allred, a one man building/remodeling team. He was perhaps 65 then – small, wiry, and very good. He would often rub his hands, cracking his knuckles – and rubbing his shoulders and rotating his arms.

“Why?” I asked.

“Arthritis – and joint deposits,” he said. “I got to break them up now and then to keep workin’.”

He hardly ever grimaced or complained. The little guy carried long 2 x 4 and even 2 x 6 boards around like they were pencils. He reminded me of Barb’s Dad, Julian: small, tough, strong, persistent, determined.

The extension gave us two bedrooms and a large garage, providing some storage and workshop space. Some years later Barb and the kids started excavating for a pond right outside the kitchen window and the front door.

## Barb and the Boys

Life was somewhat lonely for Barb. We had one car, I was very busy, our home was a bit isolated. Fortunately we ‘discovered’ the Kims, the Jarviks, and the Hibbs, all nearby, each with their own evolving families.

Sung Wan Kim and his wife, Hee-Kyung, lived even further south than we did. Sung Wan and I occasionally commuted to work together. The Hibbs arrived about 1971; John Hibbs contacted me about surface energetics – and we’ve been close friends ever since. They, too, lived nearby. Rob Jarvik was hired by Kolff in 1971 to work on the artificial heart. He and wife Elaine lived in the woods not too far from us. The Sweeneys moved to Salt Lake in 1973 and stayed for nearly two years. We interacted with them and their kids for the next nearly 40 years.

Barb got connected to the Cottonwood Play Group – a group of mothers and young kids – and to a YWCA group called Kids and Comments. Kids could play, mothers could talk. The Play Group was also a babysitting coop. Working with young kids led Barb to consider teaching as a career.

Denna Wright was another young mother, living nearby in a dome house, recently built by husband Bob Wright; Bob was a distant relation to Frank Lloyd Wright, the architect. Bob was dedicated to helping his ex-wife and daughters, as well as Denna. Denna would sometimes fondly refer to wife #1 as ‘our ex-wife.’ I think it was at his Celebration of Life in 2008 at the Unitarian Church that Reverend Tom Goldsmith quoted Bob as saying:

“It takes a damned good man to be better than no man at all.”

Bob was a talented engineer and designer. We purchased a tall semi-wooden corner lamp from him some years later – and still have it, over 40 years later.

Although the boys had been seduced by sugar to attend the local Mormon primary afterschool meetings, they soon tired of the sugar. I did think they should have some introduction to religion and Christianity. So I began to read to them a comic book style ‘Bible’ for very young kids. We couldn’t make it through Genesis! They were disgusted by all the killing and begetting. I think Aaron in particular. I was disgusted with it, too. We let it go. Aaron and Tonio are still largely secular.

Tonio started school at Oakwood Elementary, just a block north of our home; Aaron did the same two years later. By 1976 or so both boys were in school. Barb worked for a Head Start program nearby, further stimulating her teaching interests. She took courses in Education at the UU for 1–2 years, including student teaching. She began teaching 3rd grade at Lincoln Elementary, and then taught 2nd grade. She had a helpful and popular volunteer who lived near the school – Helen Bradford. They worked together for most of Barb’s 10 years at Lincoln. Barb also noticed a teacher’s aide wearing a T-Shirt which read So Many Books, So Little Time – that resonated. Carol Drown and Barb have been good friends ever since – for over 40 years.

Barb’s next 18 years of teaching were first grade at Nibley Park Elementary, closer to our home.

She connected with transplanted Britishers Stella and Harry Stern, who served as class volunteers for most of the next 15 years. Barb retired from Nibley and teaching in 2006.

Tonio joined the local Cub Scouts and participated for three years; Aaron did likewise, but not for very long. They both entered the Pinewood Derby activity and competition. Tonio got a summer job at the Greek Orthodox church just up the road from us. He helped with a nature study camp, taught by a

## Obrigado Pela Vida

Dorothy Webster. Dorothy and Barb immediately became friends. Dorothy was a Kindergarten teacher with great use of animals in the classroom. She also told Barb about the Utah Nature Study Society (UNSS) and their programs. We acquired one, then a second, dove and cage which made their way to Barb's classroom, as well as frogs, lizards, insects – and two geckos. Tonio apparently brought a friend home to collect black widow spiders from our spider-rich tool shed behind the house.

The kids entered an Open Classroom school for several years, grades 5 and 6, before going to Bonneville Middle School for grades 7–9. From there the kids routed to Cottonwood High School, graduating 1986, 1988. During his sophomore year Tonio attended Rowland Hall, a local private school, where he met some of his best friends. Barb and I were concerned with the affluence and evolving bad habits of some of his classmates, so he ended up back in public schools after the year at Rowland Hall. We may have overreacted, as all his friends turned out OK!

Frederick Kopp, a nephrologist from Munich, had come to Utah to work with Kolff on artificial kidneys. Many years later, Aaron and Tonio were joined at Cottonwood High by our 'daughter' Nina, who stayed with us for a year to learn American English, enrolling for a junior year at Cottonwood High. Nina is the daughter of Elizabeth and Frederick Kopp, who had become our very good friends; Elizabeth and Barb were very close. After Nina's stay with us, we'd joke about her two mommies and two daddies. I'd introduce Frederick as the father of my daughter. We spent many trips and adventures with the Koppes. Elizabeth died of brain cancer in about 2004.

## Entrepreneuring and Kolff – and Kopp

Kolff first caught some of the UTU entrepreneurial spirit in the early 70s. He founded a company, Vital Assists, Inc., with a friend and local hemodialysis



sales representative, Don Kettering. The company worked to commercialize technologies and inventions related to kidney dysfunction therapy.

One of their first products was single needle dialysis, invented by Klaus (Frederick) Kopp. Kolff gave all employees some stock in the firm. Via Kolff, I had met Kopp – and via Kopp, we met his wife Elizabeth; we also met Ernst Eichwald, Chairman of Pathology. Ernst was a gracious, personable, pleasant man who gathered friends and coworkers every Easter at his home on Creek Lane. Big Cottonwood Creek flowed by his large back yard. The Koppes were invited, and through them, we were as well. We met Sissy, Ernst's dynamic wife, and many pathologists, including Fazel Moatamed and his wife, Shahpar – both originally from Iran.

The Eichwald Easter Party was a very large annual event, and served to introduce and connect many different people and groups. Barb and Elizabeth Kopp became very close friends. She also met Shahpar, who became another life-long friend. We met and interacted with their kids, our kids, etc. We were now part of several communities.

The uu entrepreneurial spirit probably began with the appointment of Jim Fletcher as President in 1964. The us Army facility above the campus (built initially to keep an eye on those rebellious Mormons in Utah Territory) was largely deactivated, and most of the land transferred to the State for the University. A major piece of it was used to establish the uu Research Park, starting in 1969. Fletcher started the uu Research Institute (uuri) on part of the land.

Kolff's entrepreneurial interests were enhanced by the monetary success of Vital Assists, sold in 1976. The purchaser bought all our shares of stock at a good price. Barb and I used the money to pay off our loan to the Porters! We now had a debt-free house – we became real home owners, thanks to Kolff – and Kopp. Another miracle.

Kolff's artificial heart activities were being constrained by changes in the direction of NIH regarding cardiac-related devices. Kolff understood that he might be more effective with funds provided by commercial entities interested in health research. After approaching several firms, he met with his key people to form Kolff Associates – to develop and eventually market artificial hearts for human application. Kolff Associates was born and formed in 1976 with Kolff as Board Chair and Lee Smith as the 24 year old President. Board members included Jarvik and Donald Olsen.

Donald Olsen had become the chief artificial heart surgeon. Don was a large animal veterinarian. Almost from his first day on the Artificial Heart team, the calves with artificial hearts began surviving longer, and then much longer. Don understood their four stomachs, their vascular system, their post-op needs. Our previous surgeons didn't really know much about calves or sheep, even though they were putting artificial hearts into them!

Kolff knew he needed a charismatic, aggressive person to secure venture capital investment and negotiate agreements – including with the UTU for technology developed in Kolff's lab. Jarvik was the obvious choice, but he was young and untested. Kolff was apparently won over by meeting a Donald R Owen of Hattiesburg, MS, working at Southern Mississippi U (SMU) on polymers for heart device applications. Owen was young, charismatic, persuasive.

## **Balls – The Pim Kolff Story**

Kolff sent a delegation of us to Hattiesburg, via New Orleans, on Texas International Airlines (TI) in the mid-70s to see Owen in action. We were to look at his process for artificial heart materials and coatings and to assess his character and possible usefulness for the Utah program – and for Kolff Associates. So Tom Kessler, the lab's chief heart-maker, Lee Smith, Rob Jarvik, and I flew TI to New Orleans, where Owen met us in a small Karmen-Ghia, as Kessler recalls. I don't remember the two hours or so drive to Hattiesburg, but Tom K remembers it vividly! The five of us were loaded into the cramped Karmann-Ghia. Carbon monoxide leaked into the car because the motor was accessed from within the car and someone had to hold a lever or something to permit the car to change gears. Really! We made it, though Tom got the worst of the fumes.

We visited the lab Owen shared with Charles McCormick, who seemed to me to be the most knowledgeable of the two when it came to the materials science of what they were doing. Don Owen was of course more vocal, optimistic, persuasive – clearly a sales-oriented personality. I was impressed by McCormick. According to McCormick's recollection, Kolff flew into New

Orleans, probably on a different flight, and traveled in McCormick's car to Hattiesburg.

We returned to SLC via a greatly delayed TI flight. TI plied us with free drinks to minimize our displeasure with the delay. Tom doesn't recall imbibing, but Lee and I did, as did Rob, as I recall. We three became very vocal and creative in the far back of the plane. We outlined a biography of Kolff we threatened to write. The draft title we liked best was *Balls – the Story of Pim Kolff*. We would each write key chapters, encouraging our colleagues to contribute. No record of that potentially great book outline has been preserved – just our diminishing memories.

We did write a report to Kolff of the trip, but I can't find it. I doubt that we were very positive, but we certainly were probably not very negative. So having done his 'due diligence', Kolff hired Owen to work on hearts, promptly annoying Kessler; those two never did work well together. Given his charisma, energy, looks, and ambition, Owen surely more than annoyed Jarvik. However, he must have impressed Kolff, because Kolff hired him at the then handsome salary of \$50,000, according to Tom's recollection, then annointed Owen President of the newly formed Kolff Associates in 1976, replacing the very young Lee Smith. Jarvik was named VP of R and D. The frictions became flames. Kolff had to get rid of Owen, replacing him with Jarvik. Owen soon disappeared, later turning up in the Chemistry Dept. at Tulane University.

Kolff's skills in mentoring and empowering associates were well recognized. C William Hall, founding president of ASAIO and part of Baylor University's artificial heart program, said at Kolff's 1987 Festschrift Conference:

“As exemplified by his finding occult beauty and form in pieces of driftwood, so has Kolff discovered notable qualities in persons that were often overlooked by others.”

Yes, but I'd add that Kolff also often overlooked or simply could not see 'qualities' which might cause serious problems.

I recall a time in 1977, just before my first trip to Prague, in our property at Highland Drive, with Ian Feijen, a Dutch chemist who was working with Don Lyman, and Owen – who had come with a stately young thing latched onto his arm, somewhat provocatively attired. Feijen was telling me that Czech women are all beautiful and interesting; Owen was most interested – far more than I was.

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I was not part of Kolff Associates, or its successor Kolff Medical (1978), and later Symbion. In fact the only reason these last two pages are here is that I was interested in the personality clashes, Kolff's ambitions to work towards a human trial, and – of course – the infamous TT flight and book outline. The clinical trial ambition culminated in the UU Barney Clark event in late 1982 into 1983. There's a rich literature and history, much of it housed in the collections of the UU Marriott Library – the papers of wj Kolff and of Donald R Olsen. See also Olsen's 2015 book *True Valor*, U Utah Press. Olsen and Kessler were the people who provided the skills and expertise – the foundation – for Kolff's ideas and aspirations. Jarvik received most of the press.

## Our Little Acre

Our 1.2 acres and home required a lot of work. Our neighbor, Mazel, taught us irrigation basics – how to access the water at our weekly scheduled time, how to divert the water via small barriers and dams. The kids and I, and Barb, put in ditches, rows and channels. I would go off at dawn to direct the water towards our property. Often Mazel would get it first, and then turn it over to us when his turn was finished, then we would go back to the source and let it flow on down the canal after we'd finished irrigating. We all enjoyed watching the water move and come toward our property, then be directed to the various areas of the garden.

The home came with an old shed on its north side. In addition to housing black widow spiders, it was filled with neglected stuff, including an aged and rusted, but very useful, wheelbarrow – and a wood stove, which we never used. We bought a cheap, light roto-tiller for the garden work (the Troy-bilt came later), and a used gas lawn mower to deal with all the grass. I built a bunk bed unit for the boys. For a year or so we had a very energetic, rambunctious young dog we named Raito. One day he disappeared, probably becoming another Highland Drive roadkill victim.

We all worked on the land. I learned to prune, Barb was always planting and taking care of her plants, I'd mow, the kids and I would bundle the brush we cut

so it could be hauled away weekly by the garbage pickup. If the bundles were too long (6 ft max) or too thick (about a foot in diameter, max) the garbage guys wouldn't pick them up.

Our mail was delivered to a rural-style mailbox in the front, right on Highland Drive. Cars rounding the turn from the Van Winkle Expressway onto Highland Drive would occasionally encounter our mailbox, which I repaired every few months.

The Cottonwood Ward of the local Mormons was the property on our immediate north, including a church, a large parking lot, and a ball field. Visitors to our home would often park in the church lot and walk over to our home. Initially there was no fence. In the back of the property, just east of our living room, was the church ball field. Balls would often make it into our immediate back yard and into our planted garden further east. After several years of trying to teach the ball players to not retrieve their ejected balls (we'd throw them back onto the diamond when we found them), the church decided to put up a fence – at their expense. We agreed. One Saturday morning we experienced a typical Mormon work crew – several trucks, large men and teens with tools, rolls of cyclone fence wire, poles, etc. They had measured and calculated everything. We just watched. By late afternoon they had installed a 6 ft fence, 300 ft long, on the north side of our property. Their organization and work skills were impressive.

Between our vegetables and the orchard there was a large open space. We set up a volleyball net and a swing or two. The far easternmost portion of the land we rarely used. We ended up selling about 0.1 acre to our back neighbor, so he could increase his own back yard.

Barb and I, influenced by Paul Ehrlich and Rachel Carson, had always been interested in sustainability and planetary responsibility. We had our wonderful two children (only two!), and we now wanted me to have a vasectomy – illegal in Utah!

We wanted bicycles – and I wanted to bike to the University. This was likely stimulated by the arrival of Cedric Davern, a fascinating and charismatic transplant from Tasmania, via UC – Santa Cruz, to the U of Utah to serve as Dean of the School of Medicine. He generated some press because he would often commute to the medical school from the Holladay area, near us, on a bicycle! Well, if he could, maybe I could, too!

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We had purchased two standard 3 speed Schwinn black bicycles from Don Lyman, for something like \$25. I tuned mine up (Barb's, too) and begin occasionally commuting by bike.

It was a 10 mile one way trip, much of it uphill. But I was young. Coming home, during rush hour, on south Highland Drive, could be unnerving – due to big loud pickups tailgating me. Eventually I found several routes which avoided nearly all major commuting roads. Good exercise and not too much carbon monoxide. But as my duties increased, I would ride less and less. Ditto for Davern, I suppose.

Meanwhile the kids grew, Barb received her teacher/education credentials, I worked and received tenure, Barb's fantasy pond started to become a real project, and I got even more busy. We invited and hosted friends, colleagues, students. And we all planted, picked, mowed, pruned, bundled, watered, and dug – on our wonderful little acre – now mortgage-free.

# Utah – The Early Years – The 70s

*Materials Science and Engineering (MSE) • The Hibbs • Space •  
Welcome to Utah! – Radiation, Geography, and Pollution • UU, Kolff,  
World, 'Mutiny' • Lim, Gough, and Kolff • Carbon, Pyrogens, Clinical  
Scare • Atomic Energy – and Hoffman, Hai Bang Lee, Lyman, and Feijen  
• More Space Adventures • Lessons, Bosses, and Leadership • Barb,  
Kids, Friends – mid-70s • Current Contents, Garfield, ISI, Citations  
• Conferences, Papers, and PR • Surfaces, Interfaces, Energy, Water •  
Illegal in Utah! • Sustainability? • Utah CLEAR and de Nevers • Van  
Travels • Students, Funding, Biocompatibility • Travels and Friends •  
Proposals, Grants, Funding • Bioengineering • Socorro (Soco) and Lucero  
• Hydrogels, D.Lim, and IMC Prague - 1977 • Prague, Lim, and Kopecek –  
1979 • Big Equipment – XPS – ESCA – ISS – Surface Analysis Lab •  
Portuguese in Belgium – 1977 • Korea-1978 • Sabbatical, Fulbright,  
Portugal – 1979 • Research Methods and Techniques • Barb, Tonio,  
Aaron – Open Classroom, Land • Hikes and Excursions • TIRF and  
People • University 'Service'*

# Materials Science and Engineering (MSE)

THE NEW DIVISION of Materials Science and Engineering (MSE) needed students. Students majored in one of the four traditional engineering disciplines, or in chemistry, biology, physics, or math. Or in a ‘non-science.’

The American Chemical Society had just launched a new journal – a popular magazine – called *Chemistry*. It was targeted to the general public, students, journalists – and high school guidance counselors. So I wrote a media-type paper: Materials Science: A Modern Multidiscipline. I asked most of the faculty for input and help, especially cool pictures. It included a Scanning Electron Micrograph via John Chun (my officemate), ceramics stuff via Ivan Cutler – the best known ceramics and materials person in Utah. It covered a new Dupont plastic called Nylon 6, via Bill Statton, our new professor from Dupont Corp., and an introduction to biomedical materials. Writing it helped introduce me to all the MSE faculty and to the American Chemical Society (ACS). We purchased reprints and used it for recruitment of high school students. Later the Division became a full Department and added several additional faculty. Many were great characters.

The Division of MSE was directed by Abraham Sosin. Departmental status came in 1974. Engineering Dean Max Williams had been recruited by the UTU’s President, James Fletcher, to expand and improve engineering. He established computer science and materials science programs. Williams imported Sosin from Southern California to head up MSE – and Sosin helped recruit me. Al Sosin died in 1978 in his backyard while weeding, from an acute heart attack.

While a student at the University of Denver, I had participated in a Polymer Conference Series meeting in Denver organized by Irving Einhorn. With the Utah MSE program expanding in polymers and biomaterials, and with the coal and oil based fuel work going on in Chemical Engineering, Einhorn relocated to UTU, setting up a Flammability Research Lab (later Center) in the Research Park, and continuing with his Polymer Conference Series – now housed in Utah. I helped him one time with a talk he gave on plastics for local business leaders. He had two Kodak carousel projectors, two screens, and a projector



remote in each hand. He ascended to the podium, looking kind of like a sports celebrity, his two remote-holding hands looking like a Western gunfighter, and he attacked the lectern. He pointed and gesticulated to the two screens with his remote-pointing hands. It was incredibly entertaining, very informative. He often had to change one hundred slide tray for a second one! It was a video-like theatre performance.

Teaching duties began for me, Fall, 1969 with an Intro to Biomaterials course. Don Lyman was likely involved with a few lectures. Later I also taught the Intro to MSE course (MSE 316). A course titled MSE in Pharmacy made its debut in 1974 (Pharm 509), catalyzed by discussions with and key input from Robert Petersen, Chair, Dept. of Pharmaceutics. Peterson was serving on a US Pharmacopeia committee which was addressing pharmacy education. Peterson may have called MSE and asked for someone to help. Perhaps. I was the newest and youngest faculty member, meaning most such new ‘opportunities’ were referred to me. I was interested. We talked. The result was the very first MSE in Pharmacy course. We published a brief summary and outline of the course in the *American Journal of Pharmaceutical Education* in 1975. The textbook we planned never materialized although I did write a textbook length comprehensive set of notes (available at [www.joeandrade.org](http://www.joeandrade.org)).

Developing the Introduction to Biomaterials course took me to orthopedic materials. Back at San Jose State I had given a seminar titled Orthopedic Biomaterials, which drew my interest to corrosion-resistant superalloys, hence the initial attraction to Jack Newkirk as my first mentor at the University of Denver. In Utah those interests led me to Howard Dunn, a young orthopedic surgeon, via Larry deVries, a well known Mechanical Engineering professor whose lab was just down the hall from my office. We three met, decided to work on a tendon prostheses for the hand, involved a new MSE undergraduate student, Robert N. King, and the new MSE professor William O Statton, who was an expert on fibers.

I recall studying hand anatomy with Bob King. We had a booklet called, I think, *The Anatomy of the Hand*, illustrated by Frank Netter, a legendary anatomical artist. He was the modern version of Leonardo da Vinci, using exploded drawings and informative coloring to illustrate complex anatomy. Looking at his drawings of the incredible detail of the human hand, I had the distinct reaction

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that there's nothing we can do 'in there'. It's just too complex. Dunn assured me otherwise.

We designed, made, tested, published, and even submitted a patent application – my first. The patent application was eventually declined as the examiner had found a similar one already existed, which our search had not uncovered! The experience was useful in the filing of other applications later. And Bob King stayed on for graduate work and set up – some years later – our Surface Analysis Laboratory.

Sung Wan Kim, the friend of my Korean officemate, John Chun, hired on as a postdoc with Don Lyman, who received a large NSF grant in the early 70s. Sung Wan got involved with Pharmacy and some years later accepted a faculty position in Pharmaceutics. Robert Petersen, the chair of the Dept. of Pharmaceutics, was working to expand his department into the new area of materials and drug delivery.

Another one of those 'opportunities' appeared with the launch of a major effort by the National Academy of Sciences (NAS): the Committee on the Survey of Materials Science and Engineering (COSMAT). I didn't know at the time that Lyman was on the oversight committee of some 25 people. Various subcommittees were set up, the groups met for several years, sponsored by the NAS. I accepted the unique opportunity to serve on Panel 2: the Nature of MSE. This was a time of major discussion on the advantages and opportunities for multi- and inter-disciplinary studies and research. The new field of MSE was a product of that national awareness and vision. Biomaterials was an even more inter-disciplinary component, not yet well accepted nor understood. I was to provide some input. Max Williams, Dean of Engineering, or Don Lyman, may have suggested my name. It was a real background enhancer and eye-opener for me. Looking back at the Committee's four volume 1975 report (online at the NAS website), I found something on 'immobilized enzymes' – that must have come through me. The travel to participate at COSMAT events provided an opportunity to do many other things – and to rub shoulders and connect with many other colleagues.

## The Hibbs

In the early 70's I received a phone call from a Dr. John Hibbs, a young physician. He wanted to talk with someone about surface energy and contact angles. John had been at a conference in San Francisco and heard a talk by a man named Van Oss on something called surface energy and on the attachment of living cells onto solid surfaces – the new field of cell-surface adhesion. He'd like to talk. He was new to the **uu**, newly hired in the Dept. of Internal Medicine. He had called the College of Pharmacy, asking if they had anyone knowledgeable about surfaces. They referred him to me. I'd already been working in Pharmacy on the Materials Science in Pharmacy course, due to the interest and outreach of Robert V. Peterson. They were even processing a co-appointment for me there. So John and I met and talked. We've been colleagues and friends ever since.

I studied what Van Oss had done, learned a bit about cell adhesion, and we begin a collaboration. As I was already interested in implant biocompatibility and the foreign body reaction (FBR), John's interests and input on cell adhesion provided a foundation for my own work. We also made contact with Douglas Hill in Microbiology.

Hibbs' lab – at the Veterans Administration (VA) campus across the street from the **uu** – became the focus of our cell adhesion work. Several of my early graduate students did much of their work there, including Lee Smith and Sacha Hattori. Pat Harren, funded by Lyman, also worked with us, finishing a masters in 1974 on Hibbs' macrophages. We published several papers together, including *Water as a Biomaterial* – the paper that provided the conceptual foundation for much of my group's work.

Barb and Francoise, John's wife, met and there was an immediate friendship. We were almost neighbors. Francoise was from southern France, a scholar in French literature (Simone de Beauvoir), with a young son, Jon. She arrived at our home once carrying very young Jon in a large French bread basket. Barb had Tonio and now Aaron and an interest in the French language. Perfect. Claire and Luc Hibbs arrived some years later. We have been close ever since.

## Space

Immediately after arriving to the UU, I began to work with Kolff's artificial kidney team. I shared an office in the Merrill Engineering Building (MEB) with Dr. John Chun, a Korean metallurgist working with Gerry Byrne, a well known metallurgist. John smoked. He was assigned to recommend a scanning electron microscope (SEM) for purchase by the College. It was a very new instrument, available from a British firm and quite rare among USA universities at the time. I was asked to help John.

Our joint office was the go to and meeting place for many other Koreans, especially from Chemistry and Engineering. One in particular was Dr. Mu Shik Jhon, who had received his degree under the already famous physical and theoretical chemist Henry Eyring. Jhon and Chun were close friends; they introduced me to Sung Wan Kim, who was finishing his PhD under Eyring. Sung Wan then introduced me to his fellow Eyring group classmate, Hai Bang Lee, my very first graduate student. I went from knowing nothing about Korea to developing interest, collaboration, and affinity for the people and the culture. Barbara even likes kim chi! Jhon's interests in the structure of water provided a foundation and perspective for my work on hydrogels and their interfaces.

Kolff had been assigned some space in MEB for his artificial kidney work. Roger Kirkham was leading a small group working on dialysis membranes and kidney design. I pushed hard on my College superior, Al Sosin, and directly on Dean Max Williams, to get my own space in the Merrill Engineering Building (MEB) for my new, independent research activities. We leaned heavily on Chemical Engineering and, helped a bit by strategic squatting by me and several students, we secured access to part of a large lab in the NE corner, 3rd floor, of MEB.

Equipping a lab was difficult. I didn't know anything about the academic recruitment process when I accepted the job. Although I did know my salary, I knew nothing about 'start-up' funds, so I had no resources initially with which to purchase equipment or supplies. Working with and for Kolff helped, as his grant funds could purchase some supplies and small equipment.

Through my Pharmacy contacts I learned of the retirement of a professor of medicinal or pharmaceutical chemistry who was giving away his lab supplies

and equipment. I paid him a visit, and returned to MEB with lots of basic chemistry lab equipment and supplies. I also applied for and often received small grants from a Research Equipment Fund administered by the VP for Research, and later for small research grants from the University Research Committee.

I began a program to study the interaction of proteins with solid surfaces by using radioisotope-labelled proteins. We labelled proteins with radioactive iodine and detected the radiation emitted using a liquid scintillation counter. Later we used tritium and carbon 14-labelled tags as well. We verified that water-bearing surfaces, including hydrogels, were highly resistant to the deposition (better termed adsorption) of proteins and thus were initially more blood tolerable than materials which did tend to strongly adsorb proteins. Fortunately I had done a course on radioisotopes and radiation detection as part of my graduate work at DU.

But then I had a major scare, met a fascinating curmudgeon, and learned about Utah's poor air quality – all at the same time.

## **Welcome to Utah! – Radiation, Geography, and Pollution**

The UU has an Office of Radiological Safety, charged with seeing to it that all use of radioactive materials and research is done safely. This requires very regular training, monitoring, and inspections. The Office was run by Dr. Robert C. Pendleton. We had met; he and his staff were very helpful in getting me trained and certified to use radioisotopes.

One day a student and I were doing routine radiological safety sampling. This involved swiping lab surfaces with a filter paper to pick up dust and any other material on the surface. This time we detected much higher 'background' radioactivity than we had during earlier tests. I was alarmed. Conventional wisdom suggested that we'd had an inadvertent spill, requiring reporting and professional cleanup. I called the Radiological Health Office with great concern.

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They put Bob Pendleton on the phone, and he began to interrogate me, as if I was a sloppy nuclear terrorist. I assured him the place was clean – that we’d actually done no isotope work since the last sampling. He inquired about my counter. It was working fine, based on tests with several standards. More questions. Who has access? What about your inventory of radioactive materials. Where did you get *your* training? Clearly, a radiation spill by a young newcomer would make life harder for Dr. Pendleton – reports, criticisms, interviews.

The DU course I took on radiation safety and working with isotopes was, I thought, very good. It was that course that enabled Pendleton to authorize my use of radioisotopes. I knew about spills, how to clean and decontaminate (‘work from the periphery to the center, more or less like cleaning one’s butt’, I had been told). That made sense.

There was silence and a finger tapping sound. He was probably thinking what to do with this dumb, new assistant professor. Then full silence. Then he said, “Sample an area where you haven’t worked or walked – like under a large table.”

So I went out of our lab to an open area with stored Chemical Engineering junk – and sampled the floor there. The result was the same as in my lab. He sighed, then chuckled, then laughed.

“Welcome to Utah,” he said.

“What?”

“Welcome to Utah, home of winter thermal inversions, 4500 feet elevations, and one of the largest copper smelters in the world.”

“What?” I stammered, again.

“You need to learn about the Salt Lake Valley, Kennecott, and thermal inversions – and air pollution,” he advised.

“Give me a hint,” I suggested.

“Go outside and look West, across the Valley. You’ll see a thick lightly yellow cloud, due to our ‘normal’ thermal inversions. The air is trapped – it can’t mix with higher air, so all the pollutants of a half million people – and a huge copper smelter – all build up. You and I breathe that crap. And you just sampled some of it deposited on your lab surfaces.”

He seemed pleased to be in teaching mode.

“But why the radiation?”

“You’re in Materials, in metallurgy, right?”

I said Yes, nodding in the affirmative.

“Look up the composition of copper ore, even the relatively rich stuff in Kennecott’s Open Pit mine across the valley. The whole damn Periodic Table is in it – together with most of its radioisotopes. Much of it goes up the stack, billowing into that inverted air.”

I started to understand.

“And much of it deposits all over the place?” I cautiously suggested.

“Damn right, and some in your lungs, and much of it on the land and into the Great Salt Lake.”

“That’s a fascinating lesson,” I smiled.

“Right. You’re welcome – and welcome to Utah.”

“And my sampling report?”

“You just report your numbers as equivalent to background. Your numbers are normal – for a place with people, cars, copper smelter, and polluted air.”

He had just activated my interest in air quality and environmental pollution. Thanks, Bob.

At about the same time Kennecott was greatly upgrading, improving, and basically cleaning up its activities. It built a 1000 foot tall smokestack to help disperse the pollutants above the inversion layer, allowing Idaho and Nevada to share the pollution burden with Salt Lake City.

The new improvements will decrease the problem and hazard, although our background levels will likely always be much higher than those for people living in areas without copper smelters, urban populations and congestion, and a geography prone to thermal inversions.

## UU, Kolff, World, ‘Mutiny’

Willem (Pim) Kolff was fascinating, inspiring, creative – personally magnetic. He attracted people from all over the world. Many were very unfamiliar with life in the USA – and certainly life in the unique state of Utah. They came to work as students, fellows, co-workers, collaborators, and friends.

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In 1970 Kolff hosted a visiting professor from Prague, Drahoslav Lim. He was one of the coinventors and codevelopers of soft contact lenses. Lim worked with synthetic hydrogels for soft contact lenses – the first material developed specifically for bio-medical applications. Kolff was interested in using activated carbon to remove the biochemical factors responsible for the pathology of kidney disease. This naturally led to the idea of coating the carbon with a blood benign hydrogel. Lim also had a visiting position at Stanford U in Palo Alto, via Dr. Paul Flory. Flory, a few years later in 1974, was awarded the Nobel Prize in Chemistry ‘for his fundamental achievements, both theoretical and experimental, in the physical chemistry of macromolecules.’

The early 70s had also brought Frederick (Klaus) Kopp from Munich and Horst Klinkman, from Rostock, East Germany, as visiting researchers. Each was already well known for unique contributions to artificial kidneys.

The University of Utah used to be basically two adjacent campuses. Lower Campus housed most of the University – the Engineering Building was situated on its Northern end. The Upper Campus included the Medical School and Hospital – and Pharmacy – all higher up in the foothills of the surrounding Wasatch Mountains. Between them was a golf course and much green space – most of which are gone today. The medical campus back then included a set of ‘temporary’ wooden buildings built during WWII.

Kolff’s Division of Artificial Organs was housed in one of those buildings – in Building 512. That’s where Barb let me off in August 1968 for that initial interview and Morning Conference experience. She met Kolff at the time – he immediately noticed her eyes, remarked on her blue eyes again some 20 years later! Tonio was nursed there while I was busy interviewing with various people. Fifteen or so years later Tonio worked for Kolff on helping test a new artificial heart valve design.

The sheep and calf artificial heart experiments were performed in Bldg 512. Kolff and Mary Johnson – his dedicated, incredibly effective, efficient personal assistant – had their offices there. Neil Eastwood, a key technician and man Friday, and John Warner, the accounts and finance manager, were also there. Adjacent to the administrative spaces was the famed Morning Conference room, which was a standing room only place every work day from about 7:30 am on. The Dialysis Center was located nearby in the main hospital building.



The hiring of Don Olsen, and with that the implementation of appropriate sheep and calf post-op care, meant that the heart-implemented animals were living longer – from hours to days, then weeks, then months. That was a success. But it also meant that the many surviving animals had to be monitored and managed. We called it ‘calf-sitting’. We all had to do it. Although Kolff hired some part-time undergrads and trained them to become good calf-sitters, the need was so great that all staff were expected to perform such services. The animals required around the clock, 24/7 attention.

Most of us complained. For example, I lived 10 miles away, a 20 minute one-way commute to Building 512. Some had other nocturnal duties. I had to occasionally get up to monitor and tend to my lab’s new surface analysis instrument. I complained more loudly and more often. Kolff was, of course, very good at not hearing complaints and of getting his own way. So, I finally just said:

“No! It’s a waste of my time and of the money you’re paying me to do other things.”

Because I had a tenure-track appointment in Engineering, I was somewhat independent of Kolff – he couldn’t fully fire me. The other physician, engineer, and scientist calf-sitters all joined in. Almost all said:

“No. We agree with Joe.”

And that was it. We were replaced as calf-sitters. The animals thus received better post-op care and TLC (tender, loving care).

That was Kolff. He sometimes didn’t really mind that one of ‘his’ people would stand their ground – if it made sense to him. No grudges or vindictiveness. Onward. He was very pragmatic, readily giving generally unrequested and sometimes embarrassing advice:

‘I find the Mennen Speed Stick effective,’ he said in his famous memo of advice to staff relating to customs, expectations, social interactions: deodorant!, cleanliness, proper clothes, and manners.

It of course reminded me of a Chemical Engineering colleague, Noel deNevers, who penned a helpful advice essay for new students and faculty about life and living among the Mormons!

## Lim, Gough, and Kolff

Lim and Kolff engaged David Gough, an undergraduate materials science student, to help Lim with hydrogel work. I was very interested in PolyHEMA (poly hydroxyethyl methacrylate), the gel material Lim had developed as a soft contact lens material and was now using to coat the activated carbon. Hydrogel coatings to minimize protein adsorption was consistent with my own theoretical work on protein adsorption. Plus I was interested in coating materials with a common protein in blood – serum albumin – an idea originally suggested by Leo Vroman, author of *Blood*, and a member of my PhD supervisory committee.

David and I peppered Lim with questions. Lim was a good educator, but only in response to specific questions. He tried to induce us to derive our own answers – to do our homework. He tended to be quiet, even perhaps secretive.

We designed and built containers for the carbon particles. I engaged, using Kolff-derived support, Rick Van Wagenen to study the washing and particle generation of the activated carbons. We didn't want tiny carbon particles being released into the blood flowing through the cartridges. Klinkman and Kopp were involved in direct clinical work via the utu Dialysis Center. Another less direct but highly important participant was Mr. David Rose, a New York City real estate owner-developer.

The largely true story is that Kolff loved talking about his work. He was fascinated, driven, even obsessive. He traveled a great deal. He was already a legend in the artificial organs field when he was recruited to Utah. He was invited to talk and even demonstrate his work everywhere. While flying to these many events he looked for potential donors, funders. Sitting next to him on a plane must have been an almost grueling, as well as fascinating, experience. He would bring out stuff from his pockets: activated carbon, membrane pieces (used in the hemodialysis machines), pieces of artificial hearts (to demonstrate how it pumped, how it worked), artificial heart valves, etc. He would never have gotten through today's security checks!

David Rose sat next to him once. It turned out Rose's wife had kidney issues and either was on or needed hemodialysis. He of course gave money to help fund the work. He visited, toured the labs, met patients. I was assigned to take David around on one memorable visit. I had to use our recently acquired, very

used, uncomfortable Ford Econoline Van. I felt bad using some crappy transport for such a nice, rich, generous man. He laughed – he was old enough that he'd experienced everything and seen it all. We hit it off. He later insisted I visit his science friends in Israel, at the Weizman Institute.

## Carbon, Pyrogens, Clinical Scare

Rick van Wagenen and I, stimulated largely by Lim and Kolff, had been working on using activated carbon as a means to remove creatinine and other metabolic toxins from blood. The carbon was coated with Lim's PolyHEMA. On April 25, 1974, we did a clinical trial of the carbon cartridge unit, via a regular dialysis patient. We had received Human Experimentation Committee approval for the study a few days earlier. We collaborated with HydroMed Sciences, a New Jersey firm who had the USA rights for the Prague PolyHEMA technology. They had been working on coated carbons, so they shipped several sterile units to us.

Kolff collaborator and friend Horst Klinkman was a tall, stately, aryanesque German who did quite well as a physician scientist in the East German 'system'. He and Kolff met, connected, and collaborated years earlier via their common interests in kidney failure, hemodialysis, and artificial kidneys. Horst visited for a week or so in 1974. He initiated the Carbon Kidney clinical trial for us while he was in Utah, together with our local hemodialysis clinicians.

The test patient was receiving conventional hemodialysis. The coated carbon cartridge was in a parallel circuit. It was switched in to her blood circuit. Just as the patient's blood began to flow into the carbon unit, Klinkmann needed to get to the airport for his flight back to Europe. So he left. Seconds later the 'classical' pyrogen reaction began – chills, shaking, etc. She was immediately switched off the carbon cartridge, back to normal hemodialysis, and recovered from her acute pyrogen reaction.

I wrote a detailed report on the case in 1974, concluding that the reaction had been likely due to endotoxins, even though we had done endotoxin testing

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of all components earlier. Very scary for all. We had not tested the unit just before its clinical use. There was much concern, of course. The patient recovered. My report to Kolff of the event is at [joeandrade.org](http://joeandrade.org).

I was always concerned about the purity of the water we used. And working with Mu Shik Jhon on water structure further increased my interest. Most labs at the time had their own small still, to prepare ultra-purified water via distillation for lab use. We also had autoclaves – small, pressure-cooker like pots for the heat sterilization of glassware and small implements. The pyrogens/endotoxins come from dead bacteria. If a process is not fully sterile (bacteria – free) during every single stage, then the final product will carry dead bacteria (dead due to a final sterilization stage). If there are enough dead bacteria, there's likely to be endotoxin. If that device is then used clinically, the patient may suffer a 'classic' pyrogen reaction. If strong enough, it can be deadly.

We wanted to continue to work on PolyHEMA-coated carbons. Kolff was not turned off by our recent experience. So I talked him into acquiring a large still with which to prepare pyrogen-free water for our ongoing work. Kolff asked his New York friend, David Rose, who helped fund the artificial kidney work, for some special \$\$ for my new still. Done.

We had worked on activated carbon for about 5 years, publishing mainly in two special journals from the two major societies. The Transactions of the American Society for Artificial Internal Organs (Transactions ASAIO) – Kolff was an early member and cofounder. The second was the EDTA – the European Dialysis and Transplant Association. Each had an annual conference with published proceedings.

It was likely in late 1974, after our ill-fated only clinical trial, that I learned the British firm Smith & Nephew had been doing similar work and was launching a commercial activated carbon cartridge for liver treatment applications. So I told Kolff there was no point in continuing our activated carbon work – our ideas and development were comparable to theirs but they had better resources and a commercial interest. Kolff really didn't want us (i.e. me) to stop the work. I insisted. He was annoyed, even angry, but then respected my position and arguments.

David Gough and Rick Van Wagenen stayed on for graduate work – we sort of inherited each other. They each received a PhD in Materials Science in the mid-70s. David went on to publish some of his PhD work on enzyme

sensors in the prestigious journal *Science*. Dr. Gough later served as Chairman of Bioengineering at UC San Diego for many years.

## Atomic Energy – and Hoffman, Hai Bang, Lyman, and Feijen

I wanted to bind hydrophilic polymers and albumin directly onto the surfaces of implant materials. Most of the common medically used synthetic materials were very inert, so it was very difficult to do direct chemical attachment. I learned of high energy radiation as a possible means to modify plastic surfaces to facilitate chemical changes. That led to the study of ‘radiation-induced grafting’, a course on the subject, and Allan Hoffman. He had edited a book on the process. I attended a Boston workshop and visited him at MIT. He was so gracious. Not only did he talk with me, he took me under his wing, showing a confused kid from Utah how to use the MTA (Metropolitan Transit Authority), Boston’s old but very functional metro train system. I’d heard about it earlier via a Kingston Trio song (on another album from the Columbia Record Club) on a fare increase on the MTA.

Hoffman walked with me a bit around MIT – a place of near reverence for engineering students and faculty. I was elated. Little did I know then that Hoffman and I would be competing for funds from the same agency a year or so later. He didn’t know that either.

The U.S. Atomic Energy Commission (AEC) had a grant and contract program related to peaceful uses of atomic energy. The AEC was receptive to and even fond of using gamma radiation as a means to modify polymer surfaces. The high energy gamma photons would break chemical bonds in their passage through even inert materials, thus making them susceptible to chemical reactions. The Biology Dept had a Cobalt 60 gamma radiation source, supervised and used by Dr. John Spikes in his work on photochemistry. So I wrote a proposal to the AEC to use the method to prepare surfaces for bonding to proteins

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and to water-binding (hydrophilic) polymers. That early AEC proposal, somewhat surprisingly, was funded in early 1972, and served to help establish my small research group. A parallel but independent proposal by Allan Hoffman, newly at the Univ. of Washington from MIT, was also funded. At about the same time, with his new AEC funds, Hoffman hired a young postdoc named Buddy Ratner, who would later become a colleague, a friend, an ESCA-ophile (see below) – and teach Barb and I about chocolate zucchini cake.

Hoffman continued as a mentor and friend. One time, years later, on a seminar visit to the U of Utah, he stayed at our home. He was a great guest – and we taught him a bit about energy conservation and turning off the lights when unneeded.

Hai Bang Lee, who had completed a masters degree with Utah's most well known chemist, Henry Eyring, had been introduced to me via Sung Wan Kim, Eyring's newest Physical Chemistry PhD. Hai Bang and I began working on radiation-activated binding (called grafting) of gels onto plastic surfaces using Spikes' gamma radiation source.

Eyring had already suggested that Kim talk to Kolff, which he did, accepting a postdoctoral position working on membrane separation and blood compatibility for artificial kidney applications. Kim became a very good friend. Our wives met and became friends, as did our kids some months and years later. Our careers developed in parallel albeit in different areas and later via different Departments.

In early fall of 1969 Don Lyman was hired as a professor. Don and I were already friends; he was well known for his basic work on blood compatibility and polyetherurethanes (PEU) – the polymers he helped develop while at Dupont. He wanted to work with Kolff – and vice-versa – to perhaps use PEU for building artificial hearts and to develop improved materials for artificial kidneys. Don was assigned a large lab in the NW corner of MEB, just up the hall from my 'Korean' office.

In late 1972 a young Dutch professor, Ian Feijen, arrived to work with Lyman. Kim was also working as a post doc with Lyman. Feijen, Kim, and I became close mutual friends, going on hikes, family gatherings, and trips. Ian returned again the next year and again – many times. Feijen and Kim became close collaborators and participants in the Controlled Release Society. Ian loved

rugged rural Utah and the southwest, often trekking to look for minerals and gold particles.

David Lentz, a new Organic Chemistry PhD, came to my attention, probably via Sung Wan Kim. Lentz worked with me as a postdoctoral associate from about 1973–75. We published a series of papers on hydrogel grafting, including studies with Hai Bang on the micro-surface topography via what was then the new technique of scanning electron microscopy (SEM). Lentz introduced me to Santiago (Rene, Chago) Ramirez, a grad student from Chile in Chemistry, who wanted to do PhD work in materials.

Later Lentz moved on to Hospital, the firm that had purchased Kolff's first company, Vital Assists. Lentz did very well, advanced quickly in the medical products industry, relocated to (I think) San Diego. Later, his son, Matt, studied undergrad bioengineering at the UU and worked with me on The Leonardo exhibits (Chapter 10) – one on Raman fingerprinting and another on radioisotope detection.

I had learned that activated carbon could be effective in adsorbing poisons from blood, perhaps for poison overdose treatment. So the same coated activated carbon cartridges we were developing for artificial kidney application might double for poison treatment. Hemodialysis via cellophane and cellulosic membranes was occasionally used for severe poison overdoses. Dr. Tony Temple, a physician with the UU Hospital Poison Control Center, and I wrote an NIH grant (my first), which was funded! That allowed me to hire another student, Charles (Cheng-Nan) Chen to work on salicylate poisoning and Rene to work on iron-binding polymers, using desferrioxamine, an iron-binding drug (Desferal). I now had a real research group, funded mostly by my own grants. Rene and Lentz worked on the binding kinetics of Desferal.

Cheng-Nan's work on the pharmacokinetics, theoretical and experimental, was published in the *Journal of Pharmaceutical Sciences* in 1976 and 1978, winning the Ebert Prize for the best paper published in that journal during 1978. Tony Temple and I were proud and pleased. In later years 'Charles' adopted the name Bill, and went on to become a dentist on the East Coast. Tony left the UU and continued his career in industry, as did David Lentz.

Around this time, early 70s, I met Ennio Denti from Turin, Italy, who had come to work with Kolff in the area of artificial kidneys. Ennio came with his family, his wife and two young children. Dave Lentz and I met them at the SL

Airport. Dave and I wondered what his wife might look like. We had a picture of Ennio, but not of his family. Dave postulated that his wife would be a rotund Italian mama figure. We were surprised as they descended the stairs from the plane – she was a well dressed, thin, somewhat tall, in heels, model-like figure with an interesting neckline showing! So much for our expectations.

## More Space Adventures

My group's space needs expanded. We needed a place for Lim and Gough to work – and it needed a chemical fume hood.

The MEB was originally set up for the four traditional engineering disciplines: Chemical, Civil, Electrical, and Mechanical. The building was laid out in four sections. The Chem Engineers had the entire East quarter of the building, and the only space with fume hoods.

I would wander covetuously through the ChemE space (I was already using, via a sharing handshake, the NE corner third floor lab assigned to Department Chair Bert Christiansen – and it had a hood that we used for the radioiodination work). There was a series of small chemical labs with hoods along the East wall of MEB; several of those labs were used as faculty offices, not as labs. The Chem Engineers preferred their lab 'offices' to their smaller actual offices – and wouldn't budge.

One weekend, after borrowing the building master keys from a friend in Dean Williams' office, I took my 35 mm camera and did a walk through all that ideal ChemE space. I think Tonio and Aaron may have accompanied me. There were ice cream vending machines in MEB that they adored. We would 'sample' some of the surfaces with a white cloth – not to detect radiation but to simply show the thick layers of dust throughout much of the space. That showed that the space was not used as a lab (which needs to be clean). Nor was most of the space even used as an office. It was just used for storage or just sat there, unused. I processed and printed the best photos, made a little album, annotated it by location, and presented it to Dean Williams and his building space manager. They knew most of ChemE was doing very little research and thus



could not justify simply sitting on and occupying space which was needed for real, funded research. It worked. Williams called in Christiansen and several other Chem E faculty and showed them the ‘evidence’. They had little recourse but to release some space. One of the labs was then used by Gough and Lim, whose work was funded by Kolff, and one was assigned to me for use via the new USAEC contract, and a bit later for the NIH-funded ‘poison’ work.

Williams was a good Dean. He had many space problems to address. He was adding Computer Science, Materials Science, and Bioengineering to the four traditional engineering departments in the College. Space was always tight and reassignments always difficult.

One ChemE space reassignment occurred when the most interesting (to me) chemical engineering professor, Noel de Nevers, was on leave in Colombia with his wife. They returned some months later to discover that de Nevers’ office was now his tiny official office, not the spacious lab. ChemE had vacated it by packing everything into the smaller formal office!).

De Nevers was not pleased, but he did understand.

De Nevers had recruited me earlier to participate in his novel course Technology and Society, a course in the UTU general education program for undergraduates. I loved that course. It was Noel de Nevers, via his course, who first catalyzed my early interests in environment, pollution, population, and sustainability. Barbara and I had read Paul Ehrlich’s *Population Bomb* and had already agreed to have no more than two children. That was in about 1970, more or less.

Noel and I never worked together, although he did assist in some of Kolff’s work on fluid flow in medical devices. Once I retired, we would see each other at Emeritus Faculty luncheons. I was able to tell him in late 2018, some months before he died, how important he and his course were to me – in developing my commitment to and later actions on pollution, sustainability, and climate.

De Nevers must have introduced me back then (early 70s) to Sherm Janke and Leroy Kuehl, a biochemistry professor. We and others were very concerned with the plans to develop massive coal-fired electric generating plants in the Southwest. We formed a local group, Utah CLEAR (Concerned about Limited Energy and Air Resources) to protest and lobby against their development. De Nevers’ course, and Utah CLEAR, together with Ehrlich, Rachel Carson, Dennis and Donella Meadows, and others provided a strong background and

firm foundation for what would become a life-long quest for education, critical thinking, and sustainability. The Meadows team and the Club of Rome's 1972 report *The Limits to Growth* provided a foundation and perspective for all that followed. More on Utah CLEAR at [joeandrade.org](http://joeandrade.org).

I write some of this in late 2022, the 50th anniversary of *The Limits to Growth*. That early model was most prescient and predictive. Although we learned much, we have really done nothing to constrain exponential growth and planetary destruction.

## Lessons, Bosses, and Leadership

The Dean had to sign off on all funding proposals submitted by faculty to outside agencies and other sources. His signature verified that the proposal was technically reasonable, that the faculty and staff listed were competent to conduct and report the work, and that space and resources were available. Most faculty did not expect the Dean to actually review and critique the technical aspects of what was being proposed.

One time Dean Williams called me into his office, handed me my own proposal which he'd been asked to sign, showed me a page he had circled and scribbled:

'It's up to the P.I. to insure that the proposal is sound – not me!'

He had caught a real error – not just a typo – which had something to do with polymer physics, which he knew well. He gave me a hard, tough, minimal smile:

"Just don't ever do this again."

Later, when he asked me to represent the College in a meeting with University Higher Administration, he advised me:

"Never go into a meeting unless you know what YOU want out of it – and don't leave until you get it."

That taught me early to do my homework, including talking with people well before the meeting. Kolff had already taught me to take good notes, dated with contact information, and to regularly follow up on everything. He was a firm believer in *now*:

“...just pick up the phone and call...”

He was also a firm believer and practitioner in minimizing bullshit – keep the meeting going, get to decisions, insist on ‘bottom lines’.

Although Kolff could come across as ‘hard-nosed’, obstinate, arrogant, and very demanding, he was also very personable and attentive. He and Yanke, his fascinating wife, would send us – and other staff, of course – postcards from their many, varied travels. When they visited us they would bring activities for the boys – and give them serious attention. Some of their postcards were addressed to the boys. The Kolffs had four grown children of their own.

Pim Kolff always had a great rapport with patients and most coworkers. He would give them full, albeit always brief, attention. He had high expectations, did not tolerate missed deadlines or excuses. He tolerated mistakes, as long as they resulted in learning and eventual intellectual growth. His staff either loved him – or almost hated him. The latter group would usually leave before having to be dismissed. He did not coddle.

## **Barb, Kids, Friends – mid-70s**

Barb’s father, Julian Williams, retired in 1975 or so, on a small pension from his kind employer Bill Roth. Julian took up painting and other art projects – as well as home repair needs. His dynamic father, Gramps (Joe S Williams), died about that time – he was 92 years old. Le Rose, Barb’s mother, was always producing art, working in the late 70s on lithography, later sculpting in marble.

There was much going on in the 70s. I was so busy building my research activities and teaching that I don’t recall well what was going on, at, and near 6009 Highland Drive. We do recall buying a used upright piano in 1975, to encourage the kids’ musical talents.

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Fortunately, Barb's letters from that time to her high school friend, Marilyn Bruner, were recently discovered and reread by Marilyn, now retired somewhere in Kansas. She mailed the letters to Barb in mid-2022! – helping Barb and me to remember the 70s. Barb recalled to Marilyn that we had a large 'crop' of sunflowers towards the back of our little acre, providing a pleasant pastoral scene, and providing some lodging and food for over-wintering birds and other critters.

In the later 70s I traveled to Torino to advise Ennio Denti in the general area of biocompatibility. We also visited Ennio and his family in Torino in the 80s and perhaps the 90s. Barb accompanied me on one or more of those trips, as did Aaron. Many, many years later, long after Ennio's death, Barb and I reconnected with his son, Rinaldo (Nicola), whom we'd known only as a little boy, and visited with him in his private little 'castle' in Milan – in 2009.

Barb's PCV partner, Becky Rabanal, finished her nursing training in Grand Junction, Colorado. Barb finished her education studies and became a credentialed teacher about the same time. She did her student teaching in early 1977 as I was heading to Czechoslovakia and Belgium.

Her first class was a group of 3rd graders, but she then focused on 2nd graders and ran a bi-lingual classroom. That MA from U of Colorado was put to good use. At about this time Tonio was in 6th grade in a unique 'open classroom' (OC) program – I coop taught in the class 3 hours/week.

The Kopp's daughter, Nina, became our 'daughter' in residence, attending Cottonwood High for her junior year (1986–7), together with Tonio (senior) and Aaron (sophomore). She was a good moderating influence on the boys – and with Barb. Chen-ze Hu (later Dr. Hu) referred to her as our 'dry' daughter!

## Current Contents, Garfield, ISI, Citations

A good scientist studies the scientific literature – she does her homework. In my case relevant papers appeared in medical, biochemistry, bioengineering, and

materials science journals, as well as some in chemistry and physics. The only way to learn what was being – and had been – done was to go to libraries and study those journals. Current work was best learned in conferences and symposia – and related technical meetings.

A man called Eugene Garfield and his creation – the Institute for Scientific Information (ISI) – addressed the problem and the challenge. *Current Contents* (CC) was a weekly journal of all the Contents pages of a particular set of research-based journals. It came out on very thin onion-skin-like paper, in several topical editions. I subscribed to *CC-Life Sciences*, *CC-Physical Sciences*, *CC-Medicine*. I would speed read those thin paper booklets looking for work related to my research interests, which turned out to be very wide and broad. I could then go to the main and the medical libraries to examine the journals and read the papers. That worked – but it was time consuming. Our local libraries did not carry many of the journals I needed.

Fortunately, Garfield understood all this when he started ISI. Each issue of CC included information on how to contact the author via the US mail. It was common at the time to ask the author to mail a reprint of her paper. Nearly all scientists and researchers were pleased to do so. When an author publishes a paper, the journal offers to send him some number of such reprints for distribution – usually at a price. This was two decades or so before computers and the Internet! The individual reprints cost the authors about the same as a photocopy – and looked much better.

I became an avid consumer of *Current Contents* for the next 40 or so years. Issues were always in my backpack and on my person. I scanned and read them at any and all opportune moments, even in meetings and conferences. It was easy to listen to the speaker with perhaps 75% attention, and scan a contents page with the remaining 25%. Now we call it multi-tasking. I honestly felt that I was probably the most informed and aware of all my colleagues working in biomaterials and biocompatibility.

To facilitate scanning and rapid reading I attended a talk on speed reading. Evelyn Wood's Reading Dynamics group was Utah based and offered courses locally. I may have attended one. I obtained some of the materials and worked on speed reading, learning to scan efficiently and, I think, effectively. I expected my students, including undergrads, to also develop their scanning and attention

skills. I even told them, in nearly all my classes, to give me at least 20% or so of their attention, because occasionally there'd be material they did not know:

“So then perk up, give me your full attention, until it becomes obvious that you're no longer hearing or learning something new.”

This was decades before smart phones and laptops demanded much of their attention!

## Conferences, Papers, and PR

Kolff was a firm believer and doer regarding conferences and papers. If you didn't speak, travel, and write, your work could not have an impact. If it didn't have an impact, it wasn't worth doing. Those aren't his exact words but they do reflect his philosophy. He once said something like:

“You have to revisit, republish, present your work every five years, because most people don't do their homework.”

Barb and I went to Capri in 1972, probably to an EDTA meeting. We arrived in time for the meeting's general opening reception, which was on a boat in the harbor. There were snacks and drinks for the taking – an opportunity to network and interact with meeting participants and attendees. As I was reaching for some mayonnaise-laden treat, which had been obviously out in the sun for several hours, Barb grabbed my arm, wiggled her *no* finger, and said ‘better not!’. She had learned and taught health and hygiene during her Colombia PCV service. I obeyed. The next morning we learned that many of the attendees were ill with food poisoning!

We explored downtown Capri and its surroundings, as well as via taxi to Anacapri, a beautiful village more in the center of the island. We also experienced one of the famous blue grottos by small guided boat. I was fascinated by the internal reflection optics of such grottos and later used internal reflection as a means to study surfaces and develop biosensors. I also recall some cool jokes about quality of life from one of the speakers.

We don't recall what we did with the kids, then 2 and 4. I think we parked them with their Williams grandparents in Mill Valley while we were gone.

Most of my later technical travels were without Barb. From 1970 on the two kids required time and attention as did our new home and yard. There were the ASAIO meetings in 1970 -1972, one or more EDTA meetings and perhaps an IUPAC meeting. Two meetings resulted in two papers published in 1973 which were especially important to my career, as the papers provided a foundation for much of the direction and future work.

## Surfaces, Interfaces, Energy, Water

The 7th annual meeting of the American Association for Medical Engineering (AAMI) was set for April, 1972 in Las Vegas – and was to include a special symposium on Medical Materials, with about ten of the leading experts invited. Don Lyman was asked to participate but apparently had a conflict. He suggested I go instead. I jumped at the chance, and the organizers kindly agreed to let a young, largely unknown assistant professor give an ‘invited’ talk. Thank you, Don.

The paper was the first comprehensive review and presentation of basic surface science principles applied to protein adsorption, cell adhesion, tissue reaction, and biocompatibility – ‘Interfacial Phenomena and Biomaterials’, *Medical Instrumentation*, 7, 110 (1973). It’s still a good introduction to the subject, some 50 years later. As I knew the paper would receive some circulation and exposure. I worked very hard to make it easily comprehensible and complete, including figures and sketches from the pen of a work-study student, Manuel Arevalo. Its major scientific contribution was the minimum interfacial free energy hypothesis, a more general and correct form of some of the ‘surface energy’ ideas in vogue at the time, advocated by Don Lyman and Robert Baier.

What drives processes at an interface – the junction between two phases – is the existence of the junction itself – the discontinuity in the molecular interactions as one crosses the junction – the interface. If you can minimize that discontinuity, energetically-speaking, you minimize interfacial processes. Simple.

And that's where hydrogels came in, covered in the second basic paper in 1973, 'Water as a Biomaterial', presented at the 1973 ASAIO meeting and published in *Transactions ASAIO*.

The ASAIO meeting was held in Chicago in a large downtown hotel. We had very little money for travel and accommodations, so our single room housed five or more people, via several cot-style portable beds. There was me, Sung Wan Kim, Mu Shik Jhon, Hai Bang Lee, and Ian Feijen. Sleep was difficult, as the robust Mu Shik had a deep, penetrating, and loud snore. There was a line for the single bathroom in the morning. I recall our kimchi-eating Korean collaborators expressing loud, highly scented emissions as they did their morning stretches.

The first of the two papers I treated as a 'review' paper and was the sole author; the second I treated as a work in progress and included all involved at the time as coauthors. The basic interfacial free energy ideas were an outgrowth of my PhD work and extensive discussions with Predecki and Crimmins.

These papers introduced a number of critical concepts and strategies, including interfacial hierarchies, interface gradients, and the scaling of the processes occurring: molecular, macromolecular, cellular, and tissue. They also implied the need for measurement of the properties and characteristics of surfaces and interfaces, leading later to the development and application of methods which later became somewhat standard in the field of biomaterials science. I felt the field needed to be aware – to know of these new ideas and approaches. So I took Kolff's advice and told those who I felt should know.

Fortunately the two meetings each published lists of attendees and members, with their addresses. This was decades before email. The major way to transmit information long distances was via the telephone (expensive then) and the us post office. I purchased reprints of the two papers. In the 70s and earlier, reprints were used to respond to requests from interested, already aware, fellow scientists. I expanded the distribution by simply mailing reprints to all who should have requested them! I let the technical world know of my work by sending a reprint of the paper to several hundred scientists. It worked. In 1985, 12 years later, 'Interfacial Phenomena and Biomaterials', was selected as a Citation Classic because it was the most cited paper ever published by the journal *Medical Instrumentation*. The "Citation Classic" was in *Current Contents* 45, November 1985. I also received an award from the Society for Biomaterials the same year for 'contributions to the literature.'



Serum albumin was on my radar due to the suggestion made by Leo Vroman, author of *Blood*, and a member of my PhD supervisory committee. And one day in 1974 I spotted a large review paper on albumin in a *Journal of Medicine*, which was listed in CC-Medicine. The author was a Jarmila Janatova in Prague, Czechoslovakia. Our library did not carry that journal, so I sent her a Reprint Request postcard.

A month or two later a tall man named Jiri (Art) Janata appeared and looked in my open office door and said hello. He was working in MEB and had a copy of his wife's review paper on albumin, which I'd requested. He handed me this thick reprint, and we began to talk. His wife was working in the Biology Dept., and he was in Electrical Engineering – working with a Bob Huber, who was also working with Kolff! Soon Jarmila and I met, talked, and later she worked with me on albumin and antibody proteins.

The office Jiri entered was in the sw corner of the Merrill Engineering Building, the one I initially shared with John Chun and his Korean friends. It was an 'interior' office, meaning no windows, so I generally kept the door open – not so much to be inviting, but to capture light from the well lit hallways outside. It was a long narrow office. The North wall held my growing array of 4 drawer filing cabinets; the south wall was shelving for books, etc.; the topmost surface (about 4 ft high) was my group post office. Every member of my group, including all students I supervised, had a spot on that surface for papers and notes, specifically for them – as well as any mail for them which came into my Department mailbox. There was a small table and a few chairs to accommodate individual and small group meetings. There was a larger conference room immediately upstairs for larger meetings.

I hired work-study students for a range of inexpensive tasks. Work-study was a UU program, via federal funds, to provide financial assistance for undergrads. I had to pay  $\frac{1}{3}$  or so of their salary; the Fed program paid the rest. Several of my graduate students started as work-study funded undergraduates. David Malm, who became a versatile Man Friday, also came aboard via work-study.

It was a great resource for me, as well as for the students. I had part-time secretaries, lab assistants, and library 'gophers' (Go-For). I could afford to always have an office assistant for typing, addressing, mailing, filing – and for mailing my 'seminal' papers to literally hundreds of unsuspecting scientists. Throughout my career I facilitated getting information, especially my own

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work, to those I felt should be aware of the work, whether they thought so or not. Some call this ‘tooting your own horn’. I call it effective communication.

As I found articles in *Current Contents*, the Go-For would find the journal in the library, photocopy the desired article, and promptly return it to me. If the journal was not in the library collection, s/he would fill out a reprint request card and mail it to the author. Fortunately all the CC editions had a very small font directory of all the author addresses in each issue! All before computers! So I always had a collection of papers to read, annotate, and categorize for filing. When finished, if I felt the paper was worth saving, I’d scrawl a topic title and a file cabinet number on the paper. The Go-For then transformed into a filer, finding the right file cabinet and folder. It was probably in the early 90s that my filing inventory peaked at about 24 four drawer filing cabinets and some 100 to 200 running feet of bookshelves.

## Illegal in Utah!

*The Population Bomb* and *Silent Spring* appeared in the sixties, by Paul Ehrlich and Rachel Carson.

Barbara and I were greatly influenced by the books. Just before, and again after our marriage on Feb. 4, 1966, we urged each other to live and behave responsibly toward the environment and the planet. We agreed on two children.

We were very concerned about contraception and family ‘planning’. We did not like the effects of the pill or of condoms. We used spermicide gels and were generally very careful. Tonio was born in Denver on July 7, 1968. When child number 2, Aaron, was born in Salt Lake City (June 20, 1970), we agreed that it was time for me to get a vasectomy.

That word was not well known locally. Utah was then a highly theocratic state with a very patriarchal government – it still is, albeit somewhat less so. Vasectomy was not even legal. We asked around and were told I’d have to go out of state for a vasectomy. Fortunately my new research and teaching career at UTU included travel to professional conferences and working with medical as

well as engineering colleagues. I was referred to a physician in the Los Angeles area, located not far from LA International Airport.

Together with several co-workers from Kolff's research group, including Roger Kirkham, I was to address a Kidney Contractors' conference at NIH in the Washington, DC area (National Institute of Arthritis and Metabolic Diseases, NIAMD). I was excited and scared of the talk. We were working on hemodialysis membranes for Kolff's Artificial Kidney contract. I had been developing ideas and hypotheses related to the blood 'compatibility' of materials. The talk was to include discussion of preliminary experiments along such lines.

A senior researcher at MIT was also working on materials for use in artificial kidneys. Some of his ideas and work served as a foundation for my own, so I was excited to meet Edward W. Merrill and discuss our common interests. I was also nervous and scared as he might find my approaches inadequate or inappropriate.

In January, 1971 I boarded a Western Airlines flight to Los Angeles. Upon arrival I took a cab to the vasectomist's clinic, about 20 minutes from the airport. After a short wait, he saw me, put me on a table, and quickly performed the vasectomy. We talked. I quickly dressed, had his office call a second cab, and returned to the airport for a flight to Washington, DC. I did not expect much discomfort. But that night, in Bethesda, Maryland, my testicles were swollen and in pain. I had been warned about such aftereffects – they were to be expected and posed no danger – just discomfort.

Roger Kirkham, a young engineer managing the membrane work, was my colleague and roommate for the conference. That first evening we discussed Utah and Mormon culture – Roger was a committed Mormon. He instructed me that science – rational, objective thinking – are fine but should not get in the way of theological beliefs and culture. He keeps his Mormonism separate from his science, he said. Although we did not discuss my swollen testicles we did discuss family planning and birth control. Mormons tend to have large families – and Roger was no exception. I found it difficult to believe that one could do objective science and simultaneously believe in all the irrational aspects of an organized religion. I was to have many more such 'compartmentalized' colleagues and friends throughout my career.

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The next morning I slowly walked (waddled, perhaps) to the conference to give my talk. Edward Merrill was most gracious and helpful and did not notice that I was still swollen and in pain.

My vasectomy was a very memorable and culturally expanding event! Barbara and I were able to discard our spermicidal cream and did not have any additional children. I was not arrested, nor did I suffer any ongoing issues or concerns. And I was able to recommend clandestine out-of-state vasectomies to friends and colleagues. Vasectomy is apparently legal today in Utah. I never did locate the actual Utah statute that defined it as illegal in the early seventies.

Interestingly, I was involved with the NICHD (National Institute of Child Health and Development) at about this time, reviewing proposals related to reversible! vasectomies, male contraceptive devices (an implanted vas deferens valve which could be turned on or off from the outside, manually – really!), and spermicides. There were many materials compatibility concerns with such proposals and projects. Years later all such research in contraceptive technologies was stopped.

## Sustainability?

In the mid-70's, more or less, our planetary and sustainability life included several years of raising and consuming rabbits. We acquired two or three rabbits, including Mr. Buck, a dedicated male. We also acquired a rabbit hutch with 3 or 4 stalls. We bought rabbit food, they produced rabbit poo for our garden – and rabbits produced more rabbits. Buck was an amazing male, very good at his job. We would deliver a female to him (he was always interested) and, with little or no hesitation, she'd be mounted, he'd vibrate a bit, and it was over. Incredible. Then we kept them separated. I'm sure he felt unfulfilled almost all the time!

Making and growing rabbits was one thing – now what do we do? As we were wondering how to 'process' our rabbits, Francoise volunteered her mother, who was in town from Garrott, near Castres, in southern France, for a visit. They met Buck and his ladies.

Madame Arnaud deftly and efficiently taught us. She took a rabbit, boned him on the head to knock him out, slit the neck to exsanguinate and kill. She then showed us how to start and complete the de-skinning process, section the body, remove the entrails, and dissect or butcher the meat for cooking or freezing. This was some 50 years before the dozens of YouTube videos on the subject. We learned, we copied, we endured – and we ate.

But it was very uncomfortable, disconcerting, difficult – for both of us. We killed and butchered a few rabbits over perhaps two years. We had proven to ourselves we could – and that was sufficient. So we sold the rabbits and their hutch, said goodbye to mighty Buck, and went back to commercial chicken, vegetables, and fruit. The kids were relieved, especially Aaron. It really bothered him. I recall him dashing through the kitchen while I was doing the deed, trying not to look, shouting his angry outrage.

The Hibbs became even closer friends over the years. Other close friends at the time were Sung Wan and Hee-Kyung Kim and their kids, Kara and Alex. Barb recalls going to the local Pioneer Craft House with Hee-Kyung for ceramic and painting classes. They returned to find Sung Wan and I intensely engaged in scientific discussions, oblivious to the chaos and noise the four kinds had been making for hours! The kids loved to present puppet plays. They would block a doorway with cardboard, make a screen, and do puppet theatre for the adults on the other side. We all loved it.

## Utah CLEAR and de Nevers

My interests in the environment, population, and sustainability moved into direct activism in the early 70's. It began with Utah CLEAR – Concerned about Limited Energy and Air Resources – a small Utah citizens group focused on education and awareness of energy development in Southern Utah. The small group participated in hearings related to Kaiparowitz Plateau and Four Corners area coal power plants, air pollution, and water resources. Key early members included Leroy Kuehl, Jack McLellan, Larry Jensen, Polly Schmidt, and Sherm Janke. The group began meeting in about 1970 and was officially disbanded in

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1982. We participated in hearings, in generating public interest and input, in formulating an 'Energy Ethic', and in opposing additional and huge new generating plants based on coal. The argument was mainly air pollution and land, water misuse rather than climate change at the time. My collection of materials is at [www.joeandrade.org](http://www.joeandrade.org) under Utah CLEAR.

My environmental interests came to the attention of Noel de Nevers, a young Chemical Engineering professor who was coordinating a new course, called Technology and Society, funded in part by a curriculum development grant from the National Science Foundation. The Materials Science Division head, Al Sosin, taught one of the sections. I assume Al and Noel talked with me about participating – I jumped at the chance. De Nevers later published, via the UTU Press, a small textbook of readings for the course, Technology and Society, which included some of the materials I had been exposed to in that seminal Philosophy of Personal Values course back at SJSC. The first reading in de Nevers' collection was from Huxley's *Brave New World*. I taught the course several times, enjoyed it, and used it as a foundation for other activities, including a special section of a Multidisciplinary Issues course, called The Electrical Energy Question. Thanks, Noel de Nevers.

From the early 70's on, all of my courses and many talks, even the most technical ones, mentioned environmental issues, citizen activism, and sustainability.

## Van Travels

A year or two after settling in at 6009, we bought an old used Ford Econoline van, from a friendly carpenter who'd just retired. It had a few shelves in it and nails scattered inside. It was basically a large shell with few windows. We paid perhaps \$300 for it. Home it went, and we began to travel, modify the van, and travel more. I installed a small openable skylight in the roof, windows in the side and rear doors, bought a catalytic heater, mounted a small propane tank on the rear bumper, installed a small sink. We equipped it so we could all sleep in it. The motor was inside between the 2 front seats. We would seat one of the boys on the engine cover for great visibility.

A very early long trip was in July, 1972 – to Mexico. Barb missed her Colombian adventures – the music, the dancing. She was very interested in Mexico. I had learned that you could get to the Pacific Ocean by driving south from Utah – really. And we both wanted to see the ocean – and to introduce the kids to new places and to travel. While courting, we used to quote to each other, ‘A World of People and Places to See.’ So we drove south, skirting Phoenix, to Organ Pipe Cactus National Monument, and crossed the Mexican border to Puerto Penasco (Rocky Point). It was a small village on the far north end of the Sea of Cortez. Now it has a Wikipedia page and a population of nearly 100,000. It is sometimes called Arizona’s Beach. I can still see clearly the drive through the Sonoran desert practically to the water’s edge. There was no hint of ocean or water until we were right there. Fascinating. Although we could live in the van, we did get a room for bathing purposes.

We enjoyed the trip so much we went again two years later, via Phoenix so we could see the Olsens – they had recently moved there. We drove inland down to Guaymas, Mazatlan, and all the way down to San Blas – lots of driving. We spent a night in Mazatlan in a pleasant room off an interior courtyard. The van was parked on the street. In the morning we discovered the window open and the kids’ collection of *Ant and Bee* books was gone. I don’t recall anything else missing. *Ant and Bee* was a special set of books and a great loss. I probably had left the side wing window unlocked. Our hidden currency – pesos and dollars – were still there, stored and hidden by slipping them into the side edges of the cheap paneling materials I’d used to help transform the bare bones carpenter’s van to a functioning RV (recreational vehicle). We would find some of those bills years and even a decade later.

On one of the Mexico trips we were exploring a deserted beach area, accessed via a dirt/sand road with just a few huts nearby. We were crossing a large area of sandy road when we lost traction. Basically the van simply could not move. We got out to inspect the situation. I always carried a shovel, rope, etc. but ... Suddenly, like from out of nowhere, these kids appeared, carrying tin or plastic sheets and thin wooden panels. They had obviously done this many times. We dug a bit, slid the panels under the wheels, and slowly drove forward as they all pushed. No problem. We thanked them and paid them, and off they went with their dumb tourist emergency kit.

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Driving in summer heat we would keep the kids – and ourselves – cool by spraying water on each other via a spray bottle. It was entertaining and effective. Sea gulls liked to perch on the parked van – the kids liked to try to ‘catch’ and otherwise entertain them.

A very memorable Mexico beach incident was probably in the tent, at night, listening to a portable radio. Salt Lake City’s KSL was a very powerful AM radio station with a fairly clear channel. It would carry many hundreds, even a thousand or so, miles at night. We were tuning for KSL when I heard a voice I recognized. It was Tony Temple, now a collaborator, being interviewed about our new grant for use of activated carbon for poison treatment!

We went on many, many van trips, including one to Seattle for an ASATO meeting. We spent the night in the mountains East of Seattle, encased in snow the next morning. We then drove very carefully towards Seattle, and later up to Bellingham to see Barb’s little sister, Jill. That’s where Aaron was introduced to the enormous, fascinating slugs of the Pacific Northwest.

A mid-70s van trip to Capitol Reef found us seeing Sherm Janke and his wife. They were also in the campground. The Campground is in and adjacent to a pioneer fruit orchard, and very close to a spectacular, easily accessible hike – Cohab Canyon. As we were packing up to leave, the old van decided to not move. Some inspection showed a drive train issue. Sherm was much more auto-savvy than I was; he wriggled under the van and noted a drive train joint had fractured. He knew what to do. He got in his car and we drove to the auto parts store in ‘nearby’ Richfield. They had one in stock! We returned and replaced it. All fixed – thanks to Sherm and to good luck.

Sherm Janke worked with me on the Utah CLEAR group. He was a UTU mechanical engineering (ME) graduate student and an avid bicyclist. On his bicycle commute he’d find hardware and other interesting things on the road, most of which he harvested. He and his wife were avid Methodists and missionaries. They moved up to Bozeman where he taught ME for many years, dying in 2004.

On one of our Union City visits we routed through San Francisco and the Golden Gate Bridge to see Barb’s folks in Mill Valley. As we headed North on 101 we began to enter the Baker-Berry tunnel, which runs under the west hills of Sausalito. The van had been acting strange on the Bridge, but we carried on into the tunnel and then realized we were rolling on a flat tire! We pulled to the right and off the road almost immediately after exiting the tunnel. I began



to change the tire, the van interestingly tilted on the fairly steep grade. Vehicles do tend to slow as they enter and progress through the tunnel, but then rapidly accelerate, drawn by the light on the exit end. And there we were. No AAA. The kids stayed in the slightly tilted van. Barb and I changed the tire, noting that we would need to replace it. We tolerated the CO, heat, noise, and very smelly highway air as all those cars and trucks rolled by with their lead feet on their accelerators. Not pleasant.

We immediately went to a local Mill Valley gas station-shop, on Blithedale, as I recall. We exited 101 at Miller Ave, routed via Camino Alto to E. Blithdale. The shop at the corner found a suitable tire. Fortunately there was a dry grassy hill above the gas station where the kids could run around, Barb and I read. And after several hours, we were on our way with a properly tilted and tired van. On to Throckmorton and the wonderful Williams.

We again drove the van in August, 1978 to visit family in the Bay Area. The van was showing its age. The radiator was a pain. We carried a 5 gallon container of water in the van so we could stop, allow the radiator to cool down, and refill it. I thought I'd get it fixed after our return home. We routed via North Tahoe – the van fully gave out there and then. We checked in to a cheap motel with a small swimming pool, and found a garage of sorts willing to do the repair. But the new radiator had to be shipped in from Sacramento; that would take 2–3 days. So we enjoyed the North Tahoe area. We used the pool and explored – on foot. The big event was Tonio's first dive – I urged him on and got a photo of him going head first into the water. We were all so proud. The radiator arrived, the van was fixed, and we were on our way – no longer worried about a leaking radiator.

In the early 70s Barb and the boys were involved with the Cottonwood Play Group, a co-op pre-school in our area. I think we learned of it via programs at the downtown YMCA. She was also taking pottery classes at the nearby Pioneer Craft House. We purchased a motorized ceramists wheel and she made lots of creative, small dishes.

One of Barb's letters to Marilyn Bruner in 1972 mentioned that little sisters Antonia and Jill were 23 and 18. Antonia was living in Chicago and working as a window washer on tall skyscrapers!

## Students, Funding, Biocompatibility

Research takes money and help. The help is usually provided by graduate students and by ‘advanced’ undergraduates – those with interest, drive, competence. Some just appeared, showed up; others were actively recruited. Some knew other students and inquired as to graduate opportunities. But nearly all required support – funding – and that meant writing proposals for grants and specific projects.

In the very early 70s some of that support came via Kolff and his sources, but by the mid-70s my activities and lab were modestly ‘self’-funded. My first three PhD students graduated in 1974: Hai Bang Lee (Seoul, Korea) had been recommended by Sung Wan Kim; Rene Ramirez (Temuco, Chile) was recommended by David Lentz, a recent organic chemistry graduate who hired on with me as a post doc.; and the third was David Gough (Salt Lake City), who just showed up as an advanced engineering undergraduate. Hai Bang and David Lentz were funded via our USAEC grant (or contract), Rene was funded on my first NIH grant, with Tony Temple in Pediatrics; and David Gough’s funding I don’t recall. We often cobbled together various sources to provide a student stipend. David’s largely self-directed work on Enzyme Electrodes seeded an interest for me which did not fully materialize until several decades later, when I reoriented my work towards protein-based biosensors.

I recall a group party in Mill Creek Canyon in 1973. Lee, Rick, and others in the group got together in Church Fork Picnic Area. As we were eating and talking, Lee opens his trunk and exposes his power inverter, limes, salt, ice, a blender, and plastic ‘glasses’ – and prepares to make and present margaritas.

We could easily modify a non-wetting plastic surface to become totally wetting by just modifying an ultra-thin zone, 10 to 100 Angstroms thick. We’d been doing this via a brute force approach called radio frequency glow discharge (RFGD) – a device which generates a very reactive plasma in a confined volume. We considered applying the RFGD treatment that Lee was using in the lab to treat the rim of the plastic glasses so they’d accept salt, to make our outdoor margaritas more authentic.

Gary Iwamoto, a Materials Science and Engineering (MSE) undergrad (now a retired cancer physician!), worked on surface activation using RFGD via a Plasmod unit, sold by Tegal Corp. He treated and surface characterized polystyrene and pyrolytic carbon – a vapor-deposited form of elemental carbon made by Gulf Atomics in San Diego. It was considered a very promising new biomaterial.

It was fortunate for me to have such student creativity – and ‘productivity’ relatively quickly, thus solidifying my case for the award of tenure. Around 1974 Ivan Cutler suggested at an MSE faculty meeting, in a discussion on Retention, Promotion, and Tenure (RPT) actions, ‘why not Andrade?’ So MSE awarded me the rank of Associate Professor and Tenure. It was a bit earlier than expected, so I was especially pleased. In 1979 they made me full professor. Thanks, Ivan. Ivan died later in 1979 at the age of 55, due to complications from G-I surgery. He and his wife Beth visited us and discussed farming at 6009 Highland Dr. several times.

Back when I wrote *Materials Science and Engineering – A Modern Multidiscipline* (published 1970 in *Chemistry*), to help with our undergrad student recruitment, I had interviewed Ivan and asked many questions, including his cultural background. His answer was very succinct and appropriate:

“I am of the local culture.”

‘Local culture’ is, of course, a euphemism for Mormon.

As part of the Department’s tenure ‘homework’, letters of recommendation were requested. A colleague and somewhat of a competitor in the area of surface science of biomaterials was Robert Baier. My focus on interfacial energies didn’t synchronize with his earlier and continued focus on critical surface tension. He was highly regarded as the expert on surface science for biomaterials. He wrote:

“...There are numerous points of contention which we should debate. My basic impression ... is that you are suffering from the consequences of isolation. You seem not to have had the necessary opportunity to argue regularly with well-informed and as strongly opinionated colleagues.”

He was right. And, it turned out many years later, so was I.

William Chen finished in 1976, working closely with Tony Temple on our poison treatment grant.

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Helped by faculty in Pharmaceutics, his work resulted in a prestigious prize from the American Pharmaceutical Society. He was followed a few months later by Rick Van Wageningen, who really expanded the practicality of surface electrical measurements, stimulated in part by the work of Baier. Rick applied the method to the surfaces of living cells in culture (with John Hibbs).

Geoffrey Russell built on our work on hydrogels, begun with Lim and Gough, and studied so-called stereo-regular methacrylates. He was aided by Bill Statton and Don Gregonis. Geoff was always remembered as the guy who got the fire department into our lab! Nothing serious, fortunately – just embarrassing.

1977 wrapped up with YK Sung's PhD work completion – studies on the interactions of water with hydrophilic polymers, building in part on Hai Bang Lee's work and co-supervised by Mu Shik Jhon.

Lee Smith finished off the decade of the 70s with his work on cell adhesion as a function of surface properties, working with John Hibbs; Lee used his newly developed shear stress apparatus for quantitative measurement of cell adhesion. Robert N (Bob) King finished his work on the surface characterization of polymers, providing the basis for most of our future work on the surfaces of polymeric biomaterials.

It was from Ivan Cutler that I learned the importance and need for student supervision and mentoring. I recall hearing from him, or possibly from one of his graduate students, that he had a weekly meeting with each of his graduate students. I was a bit surprised, as I'd assumed that grad students were expected to be largely self-motivated and thus self-directed. Not so. So I met very regularly with each of my students, individually, at least once per week. We would also have a weekly group meeting, following the Morning Conference format which I learned from Kolff. Generally one student would present a topic, on her work or some other subject of interest, followed by discussion, questions, updates, and my asking, stemming from Kolff's standard:

“What do you need? How can I help?”

It was many years later that Chen-Ze Hu told me how much pressure each student felt from their individual meetings.

## Travels and Friends

In early 1974 Kolff received an invitation for a 2–4 week visiting professorship at the Free University of Amsterdam, to work and lecture in the lab of Klaas de Groot. De Groot, not yet a Dean of his school, was using Hydron, a semi-commercial form of poly 2-hydroxyethyl methacrylate (PHEMA), the gel polymer developed by Lim in the late 60's. De Groot asked Kolff about teaching a biomaterials course during his visit. Kolff had to decline the invitation and recommended me for the position. They did and I accepted, for a visit beginning mid-August, 1974. Barb joined me two weeks later.

The time at the Free University was very productive and helpful, for me and I think for De Groot and his team. I set myself the goal of fully accessing and partially digesting all of the work to date on PolyHEMA and related polymers and gels. Getting access to the library inner sanctums and removing materials for study and photocopying required much effort at persuading traditional, hesitant librarians. Two decades later Tonio would recount his experiences with Dutch librarians, saying in his fluent Dutch exaggerated accent:

“It’s simply not possible.”

I combed dozens of chemistry and polymer journals in the library, photocopying what I could and taking notes on the rest. All this was assembled into a volume (now lost to posterity) called something like *The Literature on PolyHEMA*. The key journal was *CCCC: Collection of Czechoslovak Chemical Communications*, which it turned out was also in the UU library!

Almost everything D Lim had shared with David Gough and I was somewhere in the collection of papers. We would no longer have close access to Lim, as he returned to Prague in late 1974.

Barb and the boys, now 4 and 6 years old, then arrived. We visited the Anne Frank house. We were impressed by all the bicycles and No Dog Pooping! (*Hond in God*) signs everywhere, literally Dog in Gutter.

Kolff again in early 1974 received an invite to participate in a large meeting that fall in London – on Artificial Liver Support. The work we were doing with activated carbon was directly relevant, so he must have recommended me. As the timing was perfect, I accepted.

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So Barb and the boys went on to London with me. I participated in Artificial Support Systems for Acute Hepatic (Liver) Failure – at King’s College in London. The meeting was underwritten by Smith & Nephew (s&n), a major British medical products and supplies firm. Blood treatment via activated carbon was a key subject. s&n had its own project using coated activated carbon which was presented by a Jack Fennimore. It rapidly became clear to me that s&n were very far ahead of us in coated activated carbons for hemoperfusion. Almost everyone working in blood hemoperfusion, including activated carbon, was there. The proceedings were published a year later, in 1975.

I didn’t know then that some 15 years later I’d be on a Science Advisory Panel for s&n, via a recommendation by Jack Fennimore.

We were housed at the London Tower Hotel, an incredible location. Barb recalls we took the train into London, then a cab to the Tower – but it wasn’t. The cab left us off abruptly in front of a ‘Terra’ Hotel, with our luggage and two boys, 4 and 6. So we took another cab to the Tower Hotel, which was very nice. We had to get a sitter for the conference banquet dinner. We had never experienced so many dishes and courses, so many waiters and servers, so many different glasses, all kinds of silverware, linens, name tags – a very formal and luxurious affair. An eye-opening event for the inexperienced Barb and Joe. Barb recalls visiting the basement of the Tower of London with the boys – to see a display of old equipment used for torture. Perhaps that was a stimulus for the kids’ later avid fascination in drawing monster and superhero comics.

Then we routed to Glasgow to Strathclyde University to interact with their strong bioengineering faculty. We also met a charismatic student named Johnny Walker. He took us to Loch Lomond and other local sites. The kids must have been with us. Johnny later came to Salt Lake to work with Kolff and me, while he discovered the mountains and canyons of Utah. He left us to work with Ennio Denti in Turin (Torino), Italy. He also served there as a night time Scottish-Italian disc jockey on a local radio station! He was/is a very charismatic and entertaining fellow.

After Glasgow we went to Munich, to be with the Kopps, then to Milan and Turin, to work with Denti. He took us into the Valle de Aosta, a beautiful valley at the foot of the Italian Alps. We went to the very top of Monte Bianco (Mt. Blanc), the highest peak in the Alps. We enjoyed the Denti family, Italian

cooking, and very high speed black limo rides to and from the Milan airport. Barb and the boys then routed back to SLC.

I went on to Naples and Capri for another (probably EDTA) kidney conference. Earlier, when David Rose learned I would be in Italy, he insisted, via \$\$ to Kolff, that I meet ‘his people’ in Israel, working on new approaches to polymer membranes. So from Capri I traveled to Tel Aviv to meet Ora Kedem at the Weizmann Institute of Science and her coworkers in Rehovot, just south of Tel Aviv. She was an international expert on membranes and permeability – very relevant to our work on membranes for artificial kidney applications.

My telegram from Capri wasn’t clear, as she thought I was arriving a day later than I did. Fortunately she contacted her coworker on a weekend to pick me up, attend an afternoon social function at his home, and get me settled. The discussions with Kedem and coworkers were very stimulating, and introduced me to the level of scientific quality and rigor at the Weizmann Institute.

I recall both the arrival and departure at Tel Aviv airport. It was my first introduction to serious and extensive airport security. Both at customs and at flight check-in inspection, the search and questions were very thorough. It would be some 25 years later that I encountered comparable security in the USA, after 9–11.

Upon returning to UU I informed Kolff of s&n’s work on carbon hemoperfusion, and recommended we simply phase out our work on the subject. He objected, strongly. We had some fairly strong discussions. He didn’t like to ‘lose’. But he got over the disappointment, we phased out the carbon work, and worked on our many other projects.

## Proposals, Grants, Funding

Doing research takes resources – people, space, supplies, equipment. And they all take money, which means sponsors, funders, grants, contracts. As a new faculty member I was expected to generate the resources to enable the development of a research group and results which would be recognized by the wider community, indirectly benefitting the Department, College, University, and

the State. So I wrote many, many proposals, most of which never resulted in grants or funding.

Writing an unfunded proposal, I later realized, was not a fruitless endeavor. I actually enjoyed it. It was the means to develop and hone your ideas, to organize your thinking, to ponder pitfalls and possibilities, to think through ideas and experiments before actually trying to do them. Key advice to facilitate a safe laboratory is to encourage, empower everyone to think through all experiments in advance – to ‘dry lab’ the experiment. Consider all scenarios. Anticipate the unexpected – and thus prepare for it. In 50 years of intensive, extensive work in many labs, the only real safety issue was a small explosion in a fume hood. No injuries or damage. Thanks, Geoffrey Russell! Geoff was working on HEMA-like polymers of controlled stereoregularity – tacticity.

Kolff had some major funding via the kidney and heart focused institutes of the National Institutes of Health. He was also good at getting private donations, like from David Rose. Lyman received a large NSF grant via a new program shepherded by Norman Bikales. The new grant funded Lyman’s people and, I think, Sung Wan Kim, at least initially. The University provided limited resources via a small grant program from the University Research Committee. There were nonprofits who also supplied support: American Heart Association, American Diabetes Association, National Kidney Foundation, etc. We applied to them all.

Proposals get reviewed. The agency sends copies to people to review, to evaluate, and to pass judgement on the merit of the proposed work. Those reviewers are expected to be critical and honest. Although their particular assessment, if critical, may hinder the funding of the grant, they can become useful contacts, initially anonymously. Large proposals generally result in site visits – the agency sends a team of some three to up to a dozen or so qualified scientists to review, evaluate, and make recommendations on the proposed grant. Those people you see, talk with, argue with. Although most of the proposals end up not being funded, they help make the scientific community aware of your interests, ideas, and work – which can then lead to new and additional opportunities.

The NIH had a funding mechanism called the Program Project Grant (PPG). It was for multi-investigator projects – to encourage cooperation and collaboration in addressing a complex research subject. It was normal for senior scientists to organize and submit such a grant. It was very unusual for an assistant



professor to write and submit one, due to lack of collaborators, contacts, and overall experience. So I submitted one.

Shortly after starting to work with Kolff, I aided a very creative Kolff colleague, a graduate student in neurophysiology, Bill Dobelle. He was fascinated with artificial vision, and had written a large grant application to begin the research and development toward that end. It involved a large group of scientists and engineers, including people knowledgeable in the then very new field of microelectronics and integrated circuits. He was driven, committed, persistent, and fearless – just like Kolff.

The evening the proposal was to be fully assembled for shipment to NIH, my job was to glue a piece of rice on the middle of one single page. He wanted to show to the reviewers exactly what a phosphene might look like, based on one very brief description in the literature. That was really cool, I thought – and led to my own interest in clearly presenting and demonstrating scientific and technical concepts – often called science communication. I don't recall if that particular proposal was funded, but enough of his were to build a robust, world reknown research effort. It also reaffirmed my audacious belief – and experience – that a young guy still working on his PhD could get a grant or contract funded – with someone else as the responsible, principal investigator.

Kolff was interested in literally ALL artificial organs. I recall a session in a large classroom in the building next door. On all four walls large sheets of white paper were mounted (long before electronic white boards could save to disc a file of their contents). Hanging over each large sheet of paper was a marker-type pen on a long string. Kolff and someone else led the discussion – perhaps Cliff Kwan-Gett or Bill Dobelle. Cliff was the chief surgeon and investigator on the artificial heart team. We just brain-stormed.

There were panels for Artificial Eyes, then Artificial Ears appeared. There were already nearly full panels on Artificial Kidneys – and Hearts. On and On. Hips, other joints, contraceptive devices (a popular NIH topic at the time), Artificial Liver, Pancreas, and some others were all included. It was an ongoing effort.

So this young Assistant Professor writing and submitting a PPG was not so far fetched in the Kolff world. I don't have copies of those early 70s proposals. Here's what I recall: The PPG title was something like Water as a Biomaterial, including methods to measure and characterize aqueous interfaces. It included

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Henry Eyring, our famous and controversial Professor of Chemistry. His work on the structure of water was made known to me via my Korean coworkers, Mu Shik Jhon, Sung Wan Kim, and Hai Bang Lee. The PPG must have included Lyman, Kim, Jhon, Hibbs, and others. The grant was not funded, for many good reasons.

Eyring was an incredible and controversial very openly Mormon scientist. He had a number of 'on the edge' hypotheses, including one on the structure of water. He was very personable, likeable, and a dynamic teacher. I sat in on some of his physical chemistry lectures, including one on partition of energy within complex molecules – the so called 'partition function'. After some preliminaries, he began deducing the partition function of an elephant! Clever, memorable, educational. He was internationally well known for chemical reaction rate theory – and the idea of the rate-limiting step. Once I understood the concept, it permeated my ideas and actions. It allowed one to manage time and set priorities – to decide what to focus on and do – and when. Second only, in my opinion and experience, to entropy as a fundamental concept and way of living.

It was Eyring's interests in water which likely spurred Dan W Urry's interests in hydrophobic polymers. Urry received his PhD at UTU under Eyring in 1964 and went on to develop the concepts of energy transduction via protein machines by means of hydrophobic interactions. His work dealt with the fundamental bases of energy in biological systems, resulting in the 2006 treatise *What Sustains Life? – Consilient Mechanisms*. Eyring died in late 1981, in his 81st year.

The NIH site visit to evaluate the PPG was fascinating, informative, and prescient. One of the site visitors was a chemical theorist who worked on a competitive theory for the structure of water. So he and Eyring spent much of the site visit time arguing with one another. One of the techniques we proposed to further develop and apply dealt with measurements of the electrical double layer, a concept related to the distribution of charges, of ions, at interfaces. Geoffrey V.H. Seaman was a member of the site visit team, and an expert in that arena. We certainly must have dealt with contact angles at interfaces, x-ray photoelectron spectroscopy (XPS), topography via scanning electron microscopy (SEM), means to measure cell attachment to surfaces, etc. – essentially everything covered in those two 1973 papers. It was an informative experience for all involved.

After the site visit Seaman and I talked. He confided that it was very unlikely the grant would be approved, but... he had some coworkers at NASA interested in double layer experiments planned for the Space Shuttle. One of the techniques we proposed to develop via the PPG might be of interest to NASA. He introduced me, I wrote to them, visited them outside Washington DC, and later received a contract to fund our work related to an experiment on an upcoming Space Shuttle mission. The fact that Utah's well known Senator Jake Garn was scheduled to fly on that mission likely had little to do with it. The contract funded some of our work for the next several years. The PPG and site visit enhanced my connection with the Eyring group and with future students from Korea.

## Bioengineering

The Bioengineering Department was formed in 1971 via an administrative split of the Dept. of Biophysics and Bioengineering, founded and led by Homer Warner, a pioneer in the application of computers to medicine. With the arrival of Kolff in 1967, who was very well known, literally dozens of people began to appear wanting to study Kolff-style bioengineering – medical devices, implants, diagnostics, etc.

The existing Department was not especially interested, so the University, via in large part by Engineering Dean Max Williams, organized a scission: a new Dept. of Bioengineering in the Engineering College, and a Dept. of Biophysics (later Medical Informatics) in the College of Medicine. Curtis C. Johnson was recruited from the U of Washington, returning to the UTU to Chair the new Department. He also had affiliations with Electrical Engineering (EE) and Biophysics. Given my interests I was given the option to affiliate with Bioengineering; I enthusiastically accepted the opportunity to get closer to Johnson and to Doug Christensen, another EE in Bioengineering.

Curtis Johnson was a popular and effective chairman. He had a great skill (a 'golden touch', some said) in developing collaborations and partnerships with

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the clinical medicine community, including joint projects and grants. His work focused on instrumentation and methods to diagnose and treat cancers.

In the mid 70s Curt was stricken with a type of stomach cancer, although he didn't tell me or many others. He must have foreseen the situation coming. He asked me to occupy a small office in the Bioengineering office area. I somehow squeezed into that little office, housing my growing file cabinet collection in a nearby lab space. We worked closely together. It was clear he wasn't feeling well, but he didn't want to talk about it. In March 1978 the advancing cancer killed him. I was called in and asked to serve as Chair. I hesitated, in part because Curt had been doing a great job; I felt there were others who'd be better qualified: Christensen, Lyman, Janata. The Dean gently insisted. I chaired Bioengineering for the first time from 1978–1980.

## Socorro (Soco) and Lucero

This 1975–77 'adventure' is being written on 9–8–2021, the day after we made contact – 44 years later. A connection tale.

Barb met Socorro Ortega in early 1975. She had come from Mexico to be with Gerhart Henschel, her boyfriend. They lived on Fardown Ave around the corner from our place. Socorro became pregnant, Gerhart was not interested in a baby, suggested an abortion. She refused; he threw her out. She ended up with Mariela Taddei, Barb's friend via bi-lingual teaching. Soco gave birth to Lucero, a girl, while at Mariela's on Dec. 7, 1976, about a full year after entering the us.

Soco and Lucero had their own apartment. I recall helping her move in (or out) of her apartment. Barb and I and the boys met Lucero and played with her in our home and yard. We have photos from mid-75 to mid-77. We didn't know then, but early in Jan. 1977 Soco received a letter for a deportation hearing, scheduled for March 1977.

In early August, 1977, she approached Barb with a small box of personal possessions and momentos, and asked Barb to keep it for her, as she had to leave. We don't recall any details. I put the box in our attic storage for the next 44

years. She never re-established contact. Barb and I were very busy with our lives; Soco and her baby Lucero faded into our backgrounds.

Barb and I have been getting older, now pushing 80. Not a good idea to have stuff in our garage rafters – time to ‘downsize’. So I’d been moving the stuff stored up there down – and much of it ‘out’. Placed under or beside our venerable Colombian Sapó game, dating to the first year of our marriage, was that little white box. I knew it was there, since 1997 when we moved from our Highland Drive place. So I showed the little box to Barb...

We’ll pick up the mystery 44 years from then, later.

## Hydrogels, D.Lim, and IMC Prague -1977

When Drahoslav Lim returned to Prague in 1974 he expected to return to work at the Institute for Macromolecular Chemistry (IMC); he had been one of its key founders in the mid-sixties. But the political situation had changed while he was in the USA from 1970–74. Hard-liners had taken over. He had overstayed his official permission to be abroad. He returned largely because his parents needed help. Upon returning he was essentially barred from any scientific post and barred from travel – he was declared ‘politically unqualified’. Shortly after returning to Prague, he realized he could not stay – he’d need to leave again. But he chose to leave by ‘legal’ means rather than to defect. That led to some five years of letters, appeals, frustration, difficulty, and even depression. Kolff and I wanted to do what we could to help him.

Our growing research interests in and contributions to hydrogels led to my planning a Symposium: Hydrogels for Medical and Related Applications – at the national American Chemical Society (ACS) meeting, August 27–28, 1975, in Chicago. Part of this interest was in having a good reason to invite Lim to a substantive venue which might facilitate his getting permission to leave Czechoslovakia again. In late 1974 I began working with the Polymer Division of ACS to plan for that meeting. That meant raising some sponsorship money

for foreign speakers, especially for Lim, and putting together a comprehensive multi-day program. I asked Lim to give the plenary lecture for the conference – the most prestigious and visible spot on the program. He helped use the invitation, as well as a visiting position invitation from Kolff, to initiate his paperwork for permission for foreign travel. It did not work. It took the next four years before he and his family finally received permissions to leave Czechoslovakia.

Lim's reserved spot on the program was filled by Buddy Ratner and Allan Hoffman. The symposium attracted many of the key scientists in the hydrogel field. I think that J. Kalal, the then director of the IMC, participated, but didn't have a paper in the final Symposium book, published by the ACS in 1976. My asking of Kalal to participate was in large part a strategy to help get internal support for Lim's own participation. Kalal came, Lim could not. In addition to many papers by the Utah group and by Hoffman's group, and Miguel Refojo, there was considerable international participation, especially Alex Silberberg, with the Weizman Institute in Israel, and an Amsterdam group. Two newer members of my group, Don Gregonis, a PhD synthetic organic chemist, and Geoffrey Russell, a materials science graduate student, both presented their new work on stereoregular PolyHEMA at the meeting and in the book. Sung Wan Kim also presented.

J. Kalal visited the UTU in early September, right after the Hydrogel Symposium. He was accompanied by Sam Ronel, who was directing Hydro-Med Sciences, the USA source for IMC polymer technology and licensing. Kalal and I discussed the possibility of an exchange program between my lab at UTU and the IMC in Prague. Kalal also noted an upcoming meeting in Prague set for August, 1977, as part of the IUPAC (International Union for Pure and Applied Chemistry) Microsymposium series.

Having learned earlier of the National Academy of Sciences (NAS) International Exchange Program with Czechoslovakia, I submitted a request for a visit to the IMC during August, 1977, to overlap with the IUPAC meeting. The request was accepted. I informed Kalal and made arrangements to go, including participating in the meeting on Medical Polymers: Current Problems. I presented a paper, met Helmut Ringsdorf, and interacted with Jindrich Kopecek, Lim's former student and already an internationally recognized polymer scientist. As I was there for three weeks, there was time to meet with many Czech scientists. We talked in semi-code regarding my 'friend', who was living

in Prague behind a state-imposed ‘politically unqualified’ curtain. It was best for others to not be in contact with Lim. This was in August, 1977, some six months after the famous Charter 77 declaration. Everyone was edgy and concerned with political correctness.

I was frankly a bit nervous to travel to Prague. The Berlin Wall and Iron Curtain were still very strong and functional. I was advised to learn a few words of Czech and review my very basic Russian skills before going. Regarding baggage, I was advised to not pack any books or papers which were obviously anti-Soviet or anti-Russian. Art and Jarmila Janata provided advice, including a recommend to read the classic *Good Soldier Svejk*, a semi-humorous review of Czech war, politics and bureaucracy, well known to all Czechs. I read and enjoyed it. Svejk was portrayed as a sort of a little man, who, although caught up in the wheels of the government bureaucratic machine, can cope with humor, irony, and patience – and who was very effective at dealing with futility and doubletalk.

Art Janata’s mother was visiting from Prague for the month or so before my trip. She kindly gave me some intense Czech lessons – I was good for up to 50 or so words. They were helpful in simple situations, including catching and riding the trams. I was advised to visit the Smetana Museum on one end of the Charles Bridge. Travel was no problem; neither were the passport and customs entry formalities. I don’t recall any luggage inspection.

Lim and I met under the Charles Bridge, on the banks of the Moldau, during the Conference. We discussed why he wasn’t permitted to participate in the Chicago Hydrogel meet and the nature of his current situation. Even prior to my visit I – and others – had been in correspondence with him, working to help him obtain permission to travel back to the USA, as his scientific activities in Czechoslovakia were so curtailed.

After seeing Lim, I walked into the Smetana Museum. It was filled with sound – Bedřich Smetana’s music. The windows facing the river were open. The famous Hradcany Castle was easily visible on this clear and sunny day – while Smetana’s *Ma Vlast* was playing at full volume. Phenomenal! I immediately became a fan of Smetana.

Walking in the downtown area near the Charles Bridge and Wenceslas Square, I noticed book shops everywhere. It seemed like every third

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or fourth shop was a book store or record store. The Czechs are very well educated and avid readers. I bought Smetana records.

Kim arrived for the Prague conference a week or so after I did. It was late evening. We were housed at the major 'Russian' hotel, The Internationale. Kim and several others arrived late at the hotel, so we went to the hotel restaurant to get something to eat. Kim, who'd been suffering with a stomach ulcer, tried to order milk. It was treated as a really funny joke. We learned quickly about Czech beer and foods. We had been advised to mind our tongues in the hotel, as it was considered a Russian listening post. I, of course, quickly scanned my room, inexpertly, for obvious signs of eavesdropping devices. Perhaps a bit self-important, even arrogant, on my part!

One evening, after meeting and eating with IMC scientists, I was on my way back to the hotel with several other visitors – I don't recall who. Milan Houska, one of the IMC staff, probably accompanied us. It was late, we'd had a lot to drink. We had to change trams about  $\frac{2}{3}$  of the way to the hotel, near a large intersection and traffic islands, perhaps the major intersection at Prague 6. Walking to the second tram stop, we entered a small green park-like space in the center of the intersection, and relieved ourselves. We were pretty well hidden, very little traffic. *Counsoula!* Then we got to the second tram and back to the hotel. We Peed Publicly in Prague.

Just after the meeting, Nicholas Plate, a well known Russian polymer scientist, was to give a set of lectures. It was more politically correct to lecture in Russian. But he noticed I was in the audience and graciously offered to lecture in his impeccable English. The largely all Czech audience was delighted. They much preferred English to Russian, although they could not easily say so. Plate presented an excellent set of lectures – in English. *Spasibo*, Nicholas!

The 1977 IUPAC conference resulted in a book, *Medical Polymers: Current Problems*, which set the foundation for several ongoing collaborations, particularly with Helmut Ringsdorf, a unique professor and personality from the University of Mainz in West Germany, near Frankfurt. There were tours, concerts, walks – all over.

My participation in the 1977 meeting focused on interfacial characterization of gels, stimulated in part by Silberberg's paper several years earlier at the Chicago Hydrogel Symposium. Those methods included contact angles.



Sung Wan Kim and I were impressed by the work of the relatively young (our age then!) Jindrich (Henry) Kopecek on hydrogel polymers. Kopecek had been a student of Lim's. All of us were very impressed and interested in Ringsdorf's ideas for multi-functional drug-carrying polymers for targeted drug delivery. Ringsdorf had also developed methods for the preparation of monomolecular films of polymers, which would serve as ideal surfaces for application to the development of ESCA (see below). We had very exciting and seminal discussions.

## Prague, Lim, and Kopecek – 1979

There was no apparent progress on Lim's case, and Kalal had not acted on our planned scientific collaboration. The group advocating for Lim's 'release' had received letters from him and his wife attesting to the desperateness of their situation – it sounded like depression to me.

So I asked NSF for the resources to visit again. That trip was approved and scheduled with Kalal for Feb. 1979.

Many science colleagues had been working to inform and request the Czech authorities for action on Lim's behalf. I have most of the letters. Nothing happened. The collection includes then recent Nobel winner Paul Flory, who had hosted Lim at Stanford 1972–3; Jesse Hwa, Chairman of the Polymer Division of the ACS; Kolff and myself of Utah; and officials from the NAS.

I arrived Prague Feb. 22, 1979 for a one week stay. The Czech Academy housed me at the Maranska Hotel – a 'special' hotel for visitors of the Academy. It was far away from the IMC and a bit isolated. I learned that the hard way. After a late evening of drinking and hearing Czech-Russian political jokes, my hosts walked to their cars. I insisted on taking one of Prague's usually ubiquitous red trams to the Maranska Hotel, which was quite far from where we were. I waited. No tram. Finally a lone pedestrian said something in sign language which I translated to mean: 'They stop running at 2 am.' So I walked the several miles in the cool, damp dark.

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The walk helped me sober up from the late dinner experience with the wine server. Everytime he went to refill the glass, I'd put my hand up and say *No, dekuji* – no, thank you. He never stopped. So I wrote *No* on a piece of note paper (I always had a small spiral-bound notebook in my pocket) and placed it over the wine glass. The waiter came again, saw the note, took my pen, and wrote an *A*, saying *Ano*, put the paper aside, and poured again. *Ano* means Yes in Czech! I learned that the only solution is to stop drinking from the full wine glass – leave it full.

My designated host was Milan Houska, the young scientist, reported to be politically correct, who loved to tell Czech-Russian jokes and to party. He took me on several walks and short trips. He was later to work in Utah as part of the Utah-Czech IMC exchange program. He worked with a talented experimenter Edward Brynda, who also later worked in our lab in Utah.

I met with Lim I think twice, both times walking on light snow around the Charles Bridge and the grounds of the Hradcany Castle, away from anything that could have a microphone. Cameras were not so common back then. He assured me of his desire in really leaving Czechoslovakia.

He'd need additional letters and help, which I promised, via coordination with Flory, Hwa, and Kolff – and the NAS. There were more and even stronger letters through most of 1979. It finally worked. He received permission to leave – permanently – in Jan. 1980. Jana Limova (Mrs. Lim) and their two teen children followed some months later. Lim initially (maybe?) was in Utah, then relocated to the Stanford – Palo Alto area with his family. It had been a decade long saga.

Lim immediately found work in industry and soon relocated to the San Diego area. He became affiliated with UCSD in La Jolla, collaborating there with David Gough, that young student from Utah some 10 years earlier. He died Aug. 22, 2003. UCSD hosted a Celebration of Life event on campus, at which Gough, Hwa, Kopecek, myself, and others spoke and participated. Flory had died in 1985.

It was during the 1979 Prague visit that I began to talk with Henry Kopecek about possibly coming to the UU. He was interested but cautious. In spite of the rigid political system, he was doing fairly well scientifically. He managed to travel to foreign meetings, albeit with much red tape and many constraints. But

he was clearly restless and desired the freedom and the opportunities which we in the West take for granted.

Lim taught me, Kolff, and our coworkers about hydrogels, synthetic chemistry, and lab management and operation. By working on his case, I was introduced to the IMC, Prague, and the Czech system (this all started in 1977 some 12 years before the Berlin Wall – Iron Curtain came down in 1989). I learned of the international exchange programs and scientific human rights actions. He also introduced me to Paul Flory. And although we never met in person, Flory's interest and actions in support of Lim were important in my own growth as a responsible and involved scientist. Later I obtained additional international visit and exchange support for Germany (Ringsdorf), Korea (Hai Bang Lee), and a Fulbright grant for Portugal.

## **Big Equipment – XPS – ESCA – ISS – Surface Analysis Lab**

In the early 70s I was working to apply a suite of surface and interface measurement tools to begin understanding polymer-water interfaces, and especially the hydrogel-water interface. That knowledge is really the basis of blood-materials interactions and the engineering of blood compatibility for medical devices. The Interfacial Phenomena and Biomaterials paper of 1973 had covered the basics of interface energetics and contact angle measurement and analysis. This was extended by papers at the 1975 Chicago meeting and the 1977 Prague meeting, including direct polymer-water interface measurements.

The only means then readily available to get information on chemical bonds at interfaces was infrared spectroscopy. In order to have the sensitivity to actually 'see' the very thin films at a surface or interface, the method required an enhancement – sort of a focusing – at the interface. There was an optical method called total internal reflection which was known to be especially sensitive for interfaces. The method was called ATR – attenuated total

reflection – spectroscopy. Don Lyman was using ATR in the infrared to detect chemical bonds on surfaces. Although the best method then available, it was too insensitive to detect single molecular layers at the interface.

N.J. Harrick's recent book introduced us to ATR (*Internal Reflection Spectroscopy*, N.J. Harrick, 1967); his company sold attachments for current spectrometers – at the time mainly for work in the infrared. We later used the technique in the visible and ultraviolet parts of the spectrum for surface analysis, excitation of fluorescence, and for optical sensors.

Lee Smith was an EE undergraduate who had built a laser for a science fair project. That was really unique and cool 50 years ago! Lee had been working with Kolff and with Gary Sandquist in the Mechanical Engineering Dept. on a nuclear-powered artificial heart. Sandquist was the resident nuclear engineer and was responsible for the small teaching reactor downstairs from my office in the Merrill Engineering Building (MEB). We talked.

Via our collaboration with John Hibbs, Lee began to study modified surfaces via a new quantitative cell adhesion measuring device he'd designed and built. There were commercial Petri dishes available advertised as being 'treated' to enhance cell attachment – and sold for an enhanced price. We wanted to know why and how.

The only method then known with the sensitivity to really measure what was right on the surface was x-ray Photoelectron Spectroscopy (XPS), also called ESCA – electron spectroscopy for chemical applications. The instrument used x-rays to eject electrons from the surface region via the photoelectric effect – the phenomenon which was the basis for Einstein's Nobel Prize in Physics. Only those electrons ejected right at or on the surface could escape to be measured. By measuring and thus knowing their energy, we could tell the atoms from which they came. It was an atomic fingerprint of the elemental composition of the surface.

The problem was XPS instruments were big, complex, and very expensive – about \$100,000 and up – in 1975 dollars! There were several commercial manufacturers. As I was in the 'market' (but with no budget), I was allowed to evaluate and test the available machines. Dupont Instruments made the smallest, cheapest, simplest one. I tested samples with it at their lab in Monrovia, east of LA. The instrument was not good enough for my perceived needs, but it would be helpful for some simple projects and as a training/teaching tool for me

and the students. So I rented a unit for some 9 months while evaluating others and trying to raise the needed money. Gary Iwamoto, Bob King, and I learned the basics of xPS via the ‘simple’ DuPont unit.

Evaluating, selecting, and purchasing an x-ray Photoelectron spectrometer was a time consuming, difficult, and very expanding experience. I went through the known commercial xPS instruments then available – all having roughly the same capabilities and cost. I would take ‘standard’ samples with me to assess specifications, capabilities, ease of use.

Our sister College of Mines had major research activities and funds in organic fuels – gas, oil, and coal. These sources needed special catalysts to be useful. Catalysts are materials with unique surface properties. The catalyst group, especially Frank Massoth, were also in need of an xPS/ESCA facility. So the fuels group obtained a major equipment supplement to their existing grant, the University provided a match, and we now had the resources to buy an instrument.

There were many issues, like it being located in Engineering, but largely ‘paid’ by Mines, access time allocations, costs of using the instrument, priority of use. I was still young and naive, but also committed, energetic, and driven. I spent many days and evenings evaluating several major manufacturers’ instruments in several different cities.

A relatively new instrument from Hewlett-Packard (HP) was criticized as a ‘prima dona’ instrument: too delicate, too demanding, too finicky, too complicated – and too expensive. Fortunately, just before finalizing our ESCA purchase, I went to Palo Alto to evaluate the HP 5950B ESCA. I met Mike Kelly, one of its key developers. It was an incredible unit, the only available ESCA with an x-ray monochromator built in, permitting greatly enhanced resolution and overall performance. It was based on the research and experience of Kai Siegbahn, a Swedish physicist who was then the world expert on ESCA.

I acquired HP ESCA data from a research project I did in Mike Kelly’s lab at HP, working long evening hours over several weekends. That experience sold me on the practicality and advantages of his machine. We somehow found the additional funds to purchase one. After almost making a bad choice in 1975, we acquired the Hewlett-Packard 5950B ESCA. The all nighters in Palo Alto at HP labs let me obtain data and evidence of its great usefulness for our work. The catalyst folks were pleased. We had a deal! And I would be buying, installing,

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managing and using the best and most advanced XPS instrument available. At the time there were only some 30 or so throughout the world.

We set it up in what we now called the UT Surface Analysis Lab – a cost center, meaning we could collect instrument time fees and charge on- and off-campus clients appropriate rates for sample analysis. ‘She’ was a time consuming instrument – delicate, sensitive, high maintenance. Barb called her my second wife. The kids liked her, because she required so much of my time. I would occasionally have them accompany me on weekend days when I had to ‘treat’ or repair ESCA. They liked the Merrill Engineering Building (MEB) because it had several ice cream vending machines, which we all used in abandon.

Once in a while we had to reset or reboot ESCA. The operating program was on a large, somewhat fragile, paper tape roll, with holes punched in a pattern along the tape. I’d reset the computer, load the tape in a holder/reader plugged into the computer, and push Run. The tape would slowly unwind and travel through the reader, falling onto the floor on the other side. After it had loaded, we would slowly rewind the tape on its large spool, ready for the next reboot. These were the early years of complex scientific computers.

Robert King, a graduate student working with me on surface characterization, became the lead ESCA operator and lab manager. We began soliciting samples to analyse to pay the bills. Local engineering firms, including aerospace and semiconductor firms, as well as biomaterials-based firms, became regular customers. Tanzey Doyle managed the lab in 1980 for a year while she was in the USA with her metallurgist husband.

The HP ESCA team, Mike Kelly or Laveer Fay (who did installations, training, and maintenance) informed me that one of their demo lab operators, a Mr. Paul Dryden, was going to relocate to Utah to be nearer to his family. I contacted him. He was hired, and ran our excellent Surface Analysis Lab for decades. We hired undergrads to help out. One fellow, Jim, asked to fetch a Phillips-head screwdriver, was totally clueless about tools. He’d never heard of a crescent wrench, for example. No tool or shop experience – yet his father was a well known local neurosurgeon! I learned early on that the best lab helpers were those who came via a rural upbringing.

The UT Chair of Physics, Peter Gibbs, had an interest in getting Nobelists in Physics to give Frontiers of Science public lectures. So when Kai Siegbahn received the Nobel in Physics in 1981 for his ESCA work, Gibbs was interested in

inviting him to lecture at UU. Our new ESCA instrument was designed and built according to Siegbahn's ideas and specifications – by HP. Gibbs contacted a Mr. James Sorenson, one of Utah's wealthiest biomedical industry entrepreneurs, to help fund a visit and lecture by Siegbahn. Although Jim didn't have a formal science background, he loved to be in the presence of great scientists. Jim Sorenson was a semi-controversial inventor and businessman. I don't think Pete Gibbs ever got any money out of Sorenson, perhaps in part because Siegbahn gave the dullest public lecture I ever heard. Not all nobelists are exciting. But I did get to meet and hear Siegbahn – and meet Utah's richest biomedical entrepreneur.

XPS was an incredible method. It allowed us to almost literally 'see' the electron orbitals constituting the atoms residing on a surface. X-rays knocked the electrons loose, the instrument measured their energies, and displayed them on an energy spectrum. Bob King put together a huge energy-orbital chart for the entire Periodic Table, derived from Siegbahn's pioneering studies and tables. The chart was roughly 1 x 3 ft on heavy bond paper and professionally printed. We'd give one to every user and customer.

We did a paper on sensitivity factors, using monolayer samples prepared by Ringsdorf's students as part of our USA-Germany collaborative NSF grant. We attended conferences, published, and taught the technique.

Our new Surface Analysis Laboratory, featuring the new HP ESCA, attracted users from throughout the region, including Buddy Ratner with the U of Washington. Ratner's work focused on polyurethanes, mine on methacrylate-based hydrogels – and proteins. We were the same age, young, and friendly competitors. Ratner and Hoffman would go on to build a major effort at the U of Washington on surface phenomena and characterization of medical polymers, including a national center for bio-surface analysis. In the meantime, however, Buddy was our greatest ESCA customer. He would book the instrument for a long weekend. He'd rent a car, book a motel on Wasatch Blvd, just blocks south of the UU campus, and sort of live in our ESCA lab while in town. He had a key to the place and full, unsupervised access. We had a great and reliable source of revenue, and Buddy was acquiring terrific ESCA data which helped him build the case for his own facility at the U of Washington. A win-win.

In 1978 or so we leased another unique instrument for about a year – an Ion Scattering Spectrometer (ISS) from the 3M Corporation. ISS basically 'saw' the nucleus of the various atoms on a surface. The physics was Newtonian billiard

ball-like collisions between the ions in its ion beam and the more massive nuclei populating the very surface of our samples. Simple and ultra-sensitive.

Equipped with a built-in ion beam and mass spectrometer, the ISS instrument also allowed us to analyze interfaces via ion ablation of the surface – a technique called SIMS – Secondary Ion Mass Spectrometry. We couldn't afford to keep the ISS-SIMS unit, but its one year with us was very helpful – and led to a long term consulting relationship with the 3M Corp.

## Portuguese in Belgium – 1977

After the 1977 stay in Prague and the IUPAC conference, I flew via CzechAir to Amsterdam to briefly see Klaas DeGroot and Ton deVisser, then on to Delft for a day to meet and talk with the electret expert J van Turnhout.

Electrets are materials with an induced surface polarization which imparts a surface charge. I thought the ideas might be helpful in our work on blood-compatible surfaces. I had read his 1974 book and wanted to know more.

And then it was via train to Namur, Belgium for a NATO Advanced Study Institute (ASI), which had several Portuguese participants. This began my technical connection with Portugal. My family history stemmed from the Azores Islands, and I grew up speaking Portuguese and loving Amalia Rodrigues, the great fado singer.

The ASI subject was advertised as Electronic Structure and Properties of Polymers. At the time I had become very interested in how conventional polymers could develop strong charge on their surfaces – essentially static charge. Utah's very dry climate lent itself to demonstrations via shocks when you walked on a rug and touched a metallic door handle, or when you move within bed sheets in a very dark room. I called it private lightning. We even acquired instrumentation to measure static charge in our lab.

But that wasn't what the ASI was about. It was a way for molecular theoreticians to get together and talk very basic physics and chemistry via quantum mechanics (QM). Not my area or interest! Some of the speakers, including Frank Harris, a UU physics professor I met there, defined a 'polymer' as anything with



two or more atoms. Really! To his theoretical mindset, the hydrogen molecule,  $H_2$ , was a ‘polymer’. The talks were later published under the title *Quantum Theory of Polymers*. Had I known the focus, I never would have applied, although it reminded me of studying  $QM$  for the  $U$  of Denver PhD exams. I’d recite ‘First-order perturbation theory’ to Barb and Tonio. The  $ASI$  did introduce me to mindsets, scientific blinders, and theory. Most importantly, I met some interesting people from Lisbon and Coimbra, Portugal.

We were housed in dorms on a campus, with the bathroom down a long hall. My very small private room included a tiny basin for washing. Puppy would occasionally pee in it late at night to avoid the long walk to the public toilet.

We’d eat together in a semi-formal but cafeteria-like venue. This is likely where I first heard Nini Rosso play *Il Silenzio*. It was a smooth, haunting, beautiful trumpet piece. I love it – and later bought the record, which had a gently ‘pornographic’ cover. The chef ran a large outdoor grill, fed via propane tanks. Several times we were fed tongue. I didn’t know what it was, asked, and was surprised. It was tender and tasty. Interesting.

A fun side story was the Romanian serenaders. One participant, from Spain, I think, had a young Romanian wife. Two young attendees from Romania would try to serenade her in the evenings by playing outside her window. Her older husband was not amused.

After the evening session, we’d have a chance to mingle over beer, wine, and drinks. I met Prof. Alves da Silva, a chemist at the Univ. of Coimbra. I also met a personable young couple from Lisbon, M. L. Almeida and his wife. We talked about Portugal, the Azores, the colonies, and the challenges resulting from the divestiture of the African colonies. This was only a few years after the overthrow of Portugal’s fascist regime, and the independence of most of its African colonies. Portugal was still reeling by the return of people from the colonies and mass unemployment. Powerful discussions. We also discussed Barb and I revisiting Lisbon. It was probably Alves da Silva who suggested looking into a Fulbright grant. I did.

## Korea – 1978

In mid-1978 Barb and I traveled to Seoul, South Korea – a 17 hour flight via Honolulu. We had never been west of San Francisco! The idea of going to Asia, to a new language, to an ‘exotic’ country, was very exciting. When we were ‘courting’ we’d talked about traveling together. I gave Barb a small world globe bank (we still have it!), labeled with the words ‘A World of Peoples and Places to See’. Barb was already a ‘world’ traveler via her Peace Corps travel – and we had been to Europe as graduate students – and even to Capri in 1972. But now we were going to South Korea.

In early June, 1978 the kids (then 8 and 10 years old) flew solo (we think) to Denver. They stayed with Karen and Bob Sweeney, now in Boulder again, and flew back to us in Salt Lake City after our return. Karen Sweeney kept a journal of their time together: *A Tale of Two Boys in Boulder – June, 1978*. She didn’t show it to us until some 30 years later – a wonderful surprise. They took the boys to Brainerd Lake, in the mountains west of Boulder, explored a lake-side log cabin, learned a bit of golf – Bob was an avid golfer. The kids generally behaved. We had asked them to ‘inherit’ our kids if we should depart the planet via a Soviet missile or other calamity on Korean Air. We later partially repaid them by ‘sitting’ their kids one time they made a trip to San Francisco.

Barb kept a journal of our Korea adventure. June 9 she noted seeing Japan and Mt. Fuji from the air as we flew direct to Seoul. Mu Shik Jhon met us, examined our tickets as there was a Northwest Orient Airlines strike, putting pressure on Korean Airlines (KAL), and we might need to make some changes. He noted that our return tickets were not marked as ‘Confirmed’. So Jhon ushered us downtown to the KAL office.

It was fascinating for us to hear and watch him cajole and argue with the KAL staff in Seoul regarding the confirming of our return ticket. Inquiring, we learned later that there is a sort of prestige hierarchy in Korean society – and that Jhon was ‘pulling rank’ with the more lowly staffers. Interesting.

We then got a brief tour of downtown Seoul via a Korean driving experience, and a tour of KAIS (Korean Advanced Institute of Science) and KIST, two sister research institutions. We slept well that first night. We were accommodated at the KIST (Korean Institute of Science and Technology) guest house

on a green, rural, wooded campus in the heart of Seoul. We were in a secluded oasis on a hilltop surrounded by a congested city. We were in very comfortable accommodations, with birds, greenery, and lovely views. Barb recalls waking early to a chorus of bird songs and calls.

We enjoyed bori-cha, a barley tea with a unique flavor. I was hesitant but Barb knew it via her social interactions with Hee-Kyung Kim. It was good. We were also introduced to ginseng tea, which I preferred. I drank a lot of ginseng. We were told it was very healthy, good for the libido, kept us young. We were taken to museums, shrines, and parks – and I gave some lectures. We visited the Korean Folk Village south of Seoul, hosted by Mu Shik Jhon. We experienced Korean crafts and customs, including old floor radiant heating – very informative and pleasant. I had tried to learn the Korean alphabet and was able to sound out letters – syllables and words. We visited the Sejong Museum near KAIS, where we learned about Korean printing, long before Gutenberg. We also learned about the evolution and development of modern Korean. Museum tickets are very colorful and informative in Korea.

Hee-Kyung, and her brothers, were connected to the Sam Yang Co., a major Korean firm, where Sung Wan served as a scientific advisor. Jhon and Kim were also connected to KAIS. Hai Bang Lee, as well as Jhon and Kim, took us around. There were visits to an evening musical, the National Museum, and other sites and sights. Mrs. Jhon took Barb shopping and on other excursions. She also booked a tourist tour or two. We had dinner at the Guest House with Prof. Rhee and Jhon. Rhee was on the UTU Chem faculty, a colleague of Eyring's. I assume he was a key connection with South Korean students and UTU. One evening the Jhons had us to their place for a pleasant dinner.

Y K Sung met us and got us on the train to Pusan to lecture at his University. YK had received his PhD in 1977 from the UTU under the direction of Mu Shik Jhon and me, continuing our studies on water in hydrogels. It was a five hour ride through rice fields and countryside. We recall a pleasant breakfast with the Sungs and their two young children. The Sungs took us on a tour of local national historical sites, including Kyong Ju/Gyeongju. YK rode the train with us back to Seoul, and then immediately returned home to Pusan. Perhaps he was afraid we might get lost on the way!

We visited the nearby Ajou Institute of Technology so I could present a seminar. I had been corresponding with a scientist there on thin-layer

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chromatography (TLC). The next day, June 21, we were in the air headed home via San Francisco.

Barb's notes include observations and perceptions on the people and their behavior, work, and culture. She has examples of graciousness and patience, their genuine interest in their visitors.

She notes the 'hand of man' everywhere. Everyone was busy – she didn't notice any homelessness or begging.

She notes, summarizing the experience:

"In a way it's nice not to know the language, sitting here ... or at the restaurant, I can observe passively and not act. I'm not late around here. Life is simplified... I have no work to try and accomplish during the last moments..."

It may have been on the trip home, or perhaps even on a later trip to Korea, that I encountered ginseng root in a bottle – a wine-like beverage. It was offered as a drink on the flight. I imbued. I liked it! But within minutes it had its effect. I felt light headed, a bit intoxicated, acted silly. It was likely a synergistic effect of alcohol and ginseng, the alcohol perhaps enhancing the concentration of active ginseng components in the liquid. I was told later that drinking ginseng tea helps alleviate alcohol hangovers. There are ginseng liquors, sometimes called ginseng wine – which is probably what I had. I never saw it again. Fascinating. Maybe it's time to try it again!

Walking to change planes at SFO we noticed a *San Francisco Chronicle* headline saying Blacks could now aspire to the Mormon Priesthood. LDS President Spencer Kimball had had a revelation. The restriction on Blacks was lifted. I didn't realize then how important the word *revelation* would become.

A Mormon Electrical Engineering professor, Robert Huber, and I discussed his Church several times. We threatened to each other once, sort of in jest, that we would plan and teach a course called Revelation Engineering – designed to basically change the minds of rigid Mormon patriarchs – and others. The course was never taught, though I revisited the challenge some 40 years later.

And we did go back to Korea. I went back many times. Barb joined me for a second trip some 20 years later – in August, 2000, for Sung Wan Kim's 60th birthday symposium – held on Cheju Island, southwest of Pusan.

Mu Shik Jhon was a fascinating character. His interests and work on the structure of water provided a strong foundation for my group's work on water in gels and on their interfaces. He was well known among Korean scientists and

government. He obviously enjoyed being in a major directorship role at KAIS and later KRICT (the Korean Research Institute for Chemical Technology). He liked the prestige and recognition of being at the top of the science order in Korea. Our careers went in different directions in the early 80s, although we kept in touch via Sung Wan Kim and YK Sung. Jhon died in 2004, the same year he published a popular science book on water: *The Water Puzzle and the Hexagonal Key*. Sung Wan Kim died in 2020 in Salt Lake City after a long and productive career. Our families had been very close ever since we met in 1969.

## Sabbatical, Fulbright, Portugal – 1979

After seven years on the UU faculty, I was eligible for a year of sabbatical leave. I started the year in early 1979 by traveling to Prague to see Lim – and Houska, and of course Kalal. On the way there I routed through Lisbon and Coimbra to make inquiries and housing arrangements for April in Portugal!

Nearly two years after meeting da Silva, Barb, Aaron, Tonio, and I were in Portugal, thanks to a three month Fulbright grant. Alves da Silva and I had made plans for me to work in his Department for April-June, 1979. It was a financial stretch for tickets for Barb and the kids, but we did it, staying for a few days in Lisbon, where we visited with the Almeidas via a hectic bus ride. The kids didn't behave very well, and I got really annoyed. We then moved to a pensão in Coimbra, and I began to work in a dusty unoccupied office at the U of Coimbra. We were broke but happy.

We managed to enroll the boys in a Portuguese private elementary school. They took the trolley/tram from our pensão to the school on their own. Barb and I would meet them at a garden near the school for *galão* (coffee with lots of milk), *natas* (a custard pastry), and lunch most school days. They learned some Portuguese.

Starved for English language reading materials, Aaron took a liking to D. A. Long's recently published *Raman Spectroscopy*, which I was also studying

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and had brought along. The Coimbra department had a Raman instrument and Long had recently visited (or perhaps was scheduled to visit) Coimbra during our stay. Fortunately book shops sold a Portuguese photo sticker book, *Natureza*. Both boys avidly acquired and traded the stickers. There was also a book shop with English language books nearby.

Barb contacted the local British Consulate about Portuguese lessons. She met the delightful Maria Consecas Lopes d'Azevedo, a young Portuguese student who wanted to improve her English. Perfect. She took Barb and the boys on various short excursions, including to her family home.

It was a memorable two months. We left a month early as we had all been sick and weren't doing well. But in those two months we visited beautiful Buçaco in the pouring rain, explored the ruins and village of Lousa, and Roman mosaics at Conimbriga. One of da Silva's faculty members took us on a road trip west of Coimbra to the Atlantic Coast at Figueira da Foz, an old fishing village.

While in Coimbra, on May 4–14 we trained to the French Mediterranean coast – seeing the Pyrenees from the train. I had a lecture and consulting invitation from Professors Delamare and Levy at a University in the Sophia Antipolis Research Centre, near Valbonne, almost on the French Riviera. The kids and I had spent a lot of time with our heads slightly out the train window and ended up with bad colds. After the discussions and writing a brief report and recommendations for them, that second week of May we left to the coast – Cote d'Azur – visiting Antibes and Cannes, then the long train ride back to Coimbra.

Some time later, just before leaving Portugal, we went to the Algarve, staying in a condo owned by one of the kid's school teachers. We swatted mosquitoes during a long humid night. Beautiful beaches, coves, shoreline. Then back to Lisbon by bus and then home.

A few days later I traveled to a conference organized by Ian Feijen in Eschede, The Netherlands. Participants were housed in hotels throughout the Twente area. I loved to walk – still do. So I set out from the conference site to the hotel, realizing perhaps an hour later that I'd clearly gone the wrong way. When I didn't show up, Ian sent someone to fetch me. I didn't need the vw to be Perdido.

## Research Methods and Techniques

The decade involved a great deal of domestic travel and collaboration, including conferences, service on review committees, invited lectures and seminars. It also brought ellipsometry, and infrared, fluorescence, and Raman spectroscopies to my group and research activities – as well as ESCA.

By the end of the 70's I had an array of students, colleagues, and collaborators – and enough grants to continue the journey. I was serving on site visits, doing proposal and paper reviews, serving on advisory boards, and doing consulting visits. On these various trips I would also arrange to visit other scientists and labs to enhance my awareness and perspectives. One such side trip in 1979 was to Richard Chang's lab at Yale University.

In the late 70s Rick Van Wagenen and I initiated the use of total internal reflection fluorescence (TIRF) to study the adsorption of albumin on flat surfaces – a method pioneered by Harrick and applied by Channing Robertson at Stanford. It required labeling the protein of interest, initially albumin, with fluorescein. We used an Argon ion laser in Doug Christensen's lab to excite the fluorescence. Knowing that proteins generally contain the amino acid tryptophan, Rick and I quickly realized that nearly all proteins intrinsically fluoresce in the ultraviolet; labels are not required. With the advice and help of Uu Chemistry Profs. Joel Harris and Jim Wang, we succeeded in developing uv-TIRF to study the adsorption of intact, unlabeled proteins. It wasn't easy.

uv light scatters much more strongly than visible light, meaning the weak uv fluorescence signal is buried in the noise produced by scattering from slight imperfections and interfaces in the optics, meaning we needed very good, very clean optics and excellent light separation via a high quality spectrometer. That took us into the area of low light level detection and uv optics.

The work of Richard K Chang and Marshall Long at Yale University taught and stimulated us to apply and develop very low light level detection and imaging. We also moved from a single internal reflection to multiple reflections to fully integrated optics – which opened up many paths and directions, some of which we followed and helped develop.

I was also editing the new *Journal of Bioengineering*, brought out by Pergamon Press. I don't recall exactly why – someone I met suggested to Pergamon that I might be a good and available editor for a new and perhaps needed journal. They asked, I agreed. I had not yet learned to say 'No, thanks' to such opportunities. The *Journal* was published for less than three years, from 1977–79. During that time other journals appeared that met the needs of the field.

The Biomedical Engineering Society (BMES) had its own journal, *Annals of BME*. There was much discussion of the 'proliferation' of journals. So when I engineered the merger of 'my' *Journal* with the *Annals*, I was able to claim that I was working on decreasing journal proliferation! I did learn to say No. I refused other offers to edit and manage journals, as well as major positions in professional societies, with the exception of AIMBE, the American Institute for Medical and Biological Engineering. And I chose not to wear neckties nor overly warm semi-formal 'jackets'.

## Barb, Tonio, Aaron, Open Classroom, Land

The decade of the 70s launched a variety of international collaborations – Seoul, Prague, Amsterdam, Portugal and set the stage for Mainz, Stockholm, Osaka, Beijing, Torino, and Zagreb. The globe was becoming more familiar and more and more interesting.

Aaron and Tonio helped us host many visitors in our home and garden. I recall a visit from Gerald Tanny, a scientist with the Millipore Corp. I knew Gerry was Jewish – and very kosher. After studying up on 'kosher', Barb prepared a kosher meal for us. Gerry was impressed, but then asked if the pot had ever been used for meat. When Barb had to meekly reply 'Yes', Gerry said it didn't meet his kosher standards. But he was equipped for such an eventuality.

He went over to his backpack and pulled out a can of sardines and other foods, placed them at his place at our table, and we sat down to eat. Gerry carefully opened the can of sardines. Meanwhile, Aaron, about 5 years old, stood



behind him, watching intently. After some minutes of Aaron's hovering, Gerry became clearly nervous at Aaron's close and intent examination.

"Aaron, what are you doing?" I asked.

Aaron answered, sort of incredulously,

"I want to see him eat those!"

We'd never had whole sardines before. We all laughed a bit. Aaron sat down. We continued with our 'kosher' meal.

Also in 1975 Jim Anderson and Anne Hiltner of Case Western Reserve University were our guests. Jim was an MD pathologist who also had a PhD in synthetic organic chemistry. He would go on to become one of the leading scientists in biomaterials and drug delivery systems. Jim was watching Tonio, asked him to get closer, and examined a mole on his cheek. He looked at Barb and me seriously:

"Be sure to get that removed," he advised. "It looks dangerous."

We did.

A year earlier Barb had neck surgery for a gland problem. She frightened her anesthesiologist by taking forever to come out of anectine anesthesia. After some testing and evaluation, we learned she has a pseudo-anticholinesterase condition.

Between primary and junior high schools the kids went to an Open Classroom for grades 5 and 6. Enrollment required parent participation during the school day, As Barb was teaching full time, I had the parent teaching gig for I guess 4 years, two with Aaron, and two with Tonio – in the years 1979–82. In addition to aiding the two team teachers, I assisted with math, science, and other lessons. As the Apple II Plus personal computer had just come out, and as I had one at the lab, I would haul it to the school nearly every time I taught. We learned simple Basic programming. A more advanced Apple II Plus could run the new programming language Pascal, which intrigued me by its simple, structured programming approach. So I learned it alongside the students.

I recall a brief discussion with a very young computer science professor about access to Pascal via the new Apple personal machine. He sneered dismissively:

"It's just a renegade language – won't go anywhere."

He was wrong.

Our two boys really took to the computers I acquired and used at home. We went through the history of computers in real time, including the Otrona

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Attache (with two built-in floppy disc drives!), and the first Apple Powerbook – which still runs just fine. My colleague, Dan Daniels, had purchased an early Osborne machine – clearly not very portable but transportable.

We continued our interests in sustainability. I was very interested in minimizing our use of energy, partly via the inspiration of the Utah CLEAR team. Utah State University (usu) was promoting home-made solar thermal systems for hot water pre-heating. A workshop was scheduled at Bonneville Middle School, just blocks from our home. Tonio and I signed up – he'd be my 10 year old helper. Over several weekends, we built two solar thermal panels from parts provided by the workshop fee. A good experience.

Installing the 'system' was another issue entirely. I don't like to plumb, nor did I have much time nor any experience. A year or two later the man who conducted the usu workshop agreed to 'help' me do the installation. He came, we installed the two collectors on our south facing roof. The water routed through the collectors fed our water heater, almost directly below. We were now using solar produced hot water – or at least solar-assisted.

The collectors had to be drained in the winter and when there was any threat of freezing. I recall one spring when we were returning from a trip to California, driving up the driveway, and seeing a small geyser of water issuing from the roof piping. It apparently had not been leaking for very long, and was quickly repaired. But it did make me cautious about plumbing and solar thermal systems.

Towards the late 70s our economic situation had improved, especially after paying off the mortgage. We wanted to buy land, not as a financial investment but as an investment in sustainability. So after some ads and not enough homework, we met Paul Clint, a libertarian anti-Federal lands ('sagebrush rebellion') right winger. He had land in West Canyon, SW of SLC on the south end of the Oquirrih Mountains. The Oquirrihs form the tall boundary between the Western Great Basin and the Great Salt Lake Valley. The East border of the SL Valley is the Wasatch Mountains, hence Salt Lake's thermal inversion-air pollution problem.

We looked at the maps, the costs. We could afford 10 acres at \$10,000, so we bought them and eventually received title. We've been paying Utah County property taxes ever since.

There were 20 additional acres available adjacent to our ten, and we could buy them via a monthly payment to Paul Clint – he'd carry the loan at very low interest. Terrific. We had done our house mortgage that way with the Porters – and that worked out well. So we paid Paul Clint a monthly fee for that acreage for many years. Until...

One day we received a notice of a class action suit against Clint by a dozen or so other 'landowners' who claimed he had swindled them. He declared bankruptcy, there were almost no assets as he'd been laundering our payments through his kids' trust funds. He was not making his payments on the land, so the real owner foreclosed. We all lost it all. Be careful of 'sagebrush rebellion' libertarians!

The Alta Club was a prestigious meeting and eating venue, where Salt Lake's influential and honored patriarchs would gather to talk and network. I was invited. It may have been a networking event for new faculty – I don't recall. Clueless, I accepted the invitation. Barb and I dressed up, probably one of the few times I wore a necktie, and appeared on time for the event. There was some hushed discussion and several glances as we entered. I was ushered off to one side and informed that Alta Club was a men's only facility. Welcome to Salt Lake City! Barb was annoyed but gracious. She left and drove herself home. I stayed and found a ride home. The Alta Club – and patriarchy – left a bad taste with us for decades – up to today.

## Hikes and Excursions

Mt. Olympus is a magnificent 9,000 ft peak that looms over the Eastern Salt Lake Valley. Grandeur Peak is to its north, Twin and Lone Peaks are to its south. Lone Peak is over 11,000 feet. Within the nearby Wasatch are many others – including Pfeifferhorn and Mt. Superior, with its colorfully named 'Cardiac Ridge'. Both Olympus and Lone Peak became Federally designated wilderness areas in late 1979. South of Salt Lake, in Utah Valley, is Mt. Timpanogos, a nearly 12,000 ft peak that looks over Provo, Utah Lake, and the Jordan River, which flows north to the Great Salt Lake. The Biblical connections are not

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accidental. The Eastern slopes of Mt. Timpanogos border Sundance, a summer and winter resort owned and minimally developed by Robert Redford, whose first wife was from the area.

We hiked them all,  
in groups large and small.

Wasatch apparently means ‘steep’ in Ute. The rugged, angular, steep nature of the Wasatch range reminded some of our many visitors of the Seorak Mountains in East Central Korea or the Tatras in Slovakia. We hiked them, too.

For the three decades we lived at 6009 Highland Drive, Mt. Olympus loomed in through our living room window – easily visible from the yard and our large east-facing window. We could also see Twin Peaks and even Lone Peak, barely, via our south-facing high window. We loved watching the full moon rise over Mt. Olympus. Rarely, we’d also see sunrises.

I organized many group hikes. It became a sort of rite of passage for new members of the group. Nearly all of my students went on some of the hikes, as did many of our visitors. Mt. Olympus was the most common because it was so accessible, with magnificent views all the way up and down, although its six mile total length and the fact that it was so steep made it a rugged, strenuous, memorable walk.

Barb and I recall one early student ‘recruitment’. Willem Prins was a well known gel and network chemist-theorist at Syracuse University in the early 70s. He died in summer 1974 in a boating accident. One of his undergraduate students, Sacha Hattori, inquired about graduate work with us. The fact that she had worked with Prins made her of interest to me. Her family and roots were in Japan. On her way back from Japan one summer, perhaps in 1974, she visited. Barb and I picked her up on campus (I’d probably arranged a room in the dorms for her brief visit), and wisked her up to Lake Blanche in Big Cottonwood Canyon. It’s a 3 mile, each way, hike with some steep sections, ending at the beautiful high mountain Lake Blanche, sitting in the shadow of Mt. Superior and other peaks. She was a trooper. But trans-Pacific jet lag and the altitude caught up with her once we were back in the car, and she slept all the way back to the dorm! But she accepted our offer and finished her PhD in our group, meeting her husband to be in our labs – and participating in many group hikes.

Barb and I soon acquired cross country skis, boots, and poles and explored the road and several of the easiest trails at the top of Mill Creek Canyon. Lee

Smith also provided us with winter outdoor adventures. He was working with Kolff and knew John Warner, Kolff's financial administrator and organizer of the Kolff group's outdoor events. It was John who first introduced us to the magnificent Mt. Timpanogos hikes, just east of Provo, Utah.

Lee's family had a sheep ranch east of the town of Heber, just north of Strawberry Reservoir. The ranch house was close to us 40 and easily accessible, even in winter. Lee and John would organize an informal weekend outing to the place, usually near the full moon in February of each year. We would bring cross-country skis and do day and night-time treks on the roads on the property. It was adults only – no kids. Barb recalls, as she was almost always the smallest and slowest participant, being very concerned about being accosted by mountain lions during the evening ski treks. Later the Smiths sold much of the ranch to the BLM, keeping the ranch house and a section or so of surrounding land. Barb and I would often bring a guest couple with us. There was always a fire, drinks, some food, and lots of talking. We got to know many on the Kolff team via the events at 'Smith's Ranch'.

## TIRF and People

As the 70's ended we made contact with Jerry Swalen and John Rabolt, IBM, San Jose; continued our interactions with Richard Chang and Marshal Long at Yale; learned of F Rondelez and his collaborators in Paris; and learned from many others to fully develop and apply TIRF to the study of protein adsorption and the characterization of interfaces. We collaborated with the polymer community, especially the Prague group and Helmut Ringsdorf, University of Mainz, in the preparation of polymer surfaces suitable for our work. We hosted visitors, exchange scientists, and others to learn the methods and to apply them – France, Germany, Netherlands, Sweden, South Korea, Japan, Czechoslovakia. It was a rich, international, dynamic time.

In 1978 or so Ernst Eichwald wanted to retire as Chair of Pathology. The Department launched a search. Reginald Mason was a pathologist and blood compatibility researcher who Kim, Lyman, and I thought might be a good

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candidate. Reg did apply and was appointed chair in 1979, allowing Ernst to begin his well earned retirement (he kept doing research almost until his death at age 94!).

During the interview process, Barb and I hosted Reg and his wife at our home for dinner. We had been having some problems with our plumbing. The two solar thermal collectors that Tonio and I had built, via the local usu workshop, were being plumbed into our water heater; the job was not yet finished. So here are our guests, dining and talking, and water begins to flow onto the floor, moving towards the dining table. I noticed and stopped it quickly. No real problem. We continued.

Then from the small utility room, which housed our clothes washer and hot water heater, adjacent to the dining area, we watch an adventurous mouse, then another, busily exploring in the direction of Reg and his wife. She sort of screamed, as did Barb. We quieted things down, the mice went away, and Reg later accepted the position. His wife apparently thought Utah was the wild, primitive West, and chose to stay in South Carolina while Reg worked in Utah. Not a good situation.

Although we didn't work very closely together, I did interact with two research professors who came with Reg to Utah: Hanson Chuang and Fazel Mohammad. Hanson had protein adsorption interests, as did Sung Wan and I – and Don Lyman. Fazel was more into the coagulation process and hematology. They worked closely with Kolff and his staff in Artificial Organs.

Unfortunately we lost Reg two years later. He chose to end his own life, alone. Apparently there were difficulties and problems that he chose not to share. He always seemed calm, friendly, well balanced – a real gentleman.

## University 'Service'

In the late 70s or early 80s I was 'elected' to the Faculty Senate, representing the College of Engineering. This was considered a thankless duty and an opportunity to fulfill my 'service' obligation to the University. Most faculty thought it a waste of time. I liked it. I met interesting people from throughout the campus,

dealt with issues of which I was largely unaware, and made a quick reputation for making good suggestions and facilitating efficient proceedings and decisions.

Noel deNevers was another Senate rep at the same time as I was. I recall a brief study, analysis, and presentation he made related to standards, admissions, and resources. He showed a roughly inverse correlation between uu entrance exam scores and uu gradepoint average – the ‘smartest’ students were receiving the lowest grades – and vice versa. That was confusing. Then he showed that the high achieving high school students chose to study Science, Engineering, and other more ‘difficult’ subjects, whereas the lower achieving entering students majored in Education, Communications, and Business. Fascinating! We had much discussion on grade ‘inflation’, standards, work load, expectations, etc. Noel led the charge for standards and quality.

And so did Jesse Jennings, who was senior to deNevers and me. Jennings already had a reputation as a somewhat curmudgeonly professor of Anthropology, very concerned with standards and quality. He was the founder and head of the Utah Museum of Natural History (UMNH) near the Administration Building.

I ended up on a Senate sub-committee headed by Jennings. I don’t recall the subject or task, but it was likely related to standards and grading. We sort of connected. We were concerned for the University – its challenges and needs, and expressed many of the same ideas, goals, expectations, and criticisms. I think he felt I was one of the few young faculty worthy of his time and attention. It was much, much later that I read parts of his memoir, *Accidental Archeologist*, 1994 – long after he’d retired in 1986 and moved to Oregon. I wish I’d read it earlier and had gotten to know him better.

Some quotes from *Accidental Archeologist*:

*“I consciously tried to undertake all research with my mind empty. Whether in the field, laboratory, or library, I never had a hypothesis to test, a point to prove, nor an opinion to support.*

*Sergeant Joe Friday of Dragnet always found the truth: ‘Give us the facts, ma’am. Just give us the facts.’ In archaeological research, facts are more valuable than preconceptions.*

*Stuart Chase long-ago labeled the ‘tyranny of words’; words color and affect our perceptions of the world...*

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*Speculation is really fun, because little or no data are required.*

*Utah Museum of Natural History is the most important project that I undertook – a 40 year gestation period for one idea seems ridiculously long.*

*The committee system – a device widely used by administrators to avoid making decisions.*

*The most prestigious committee, of course, is the faculty senate.... I quite enjoyed the Senate.*

*David Gardner from California was selected to replace Fletcher [as UU President] after a long search. During an orientation visit by Gardner... I edged up to the group and introduced myself, saying quietly there are no formal luncheon plans, so I'm inviting you to lunch at the Museum to get acquainted with its potential....We went back to a storm of the century and verbal abuse if not actual vilification directed at me. The kidnapping had been done so quickly that no one realized the man was gone and would be gone for over an hour; indeed, no one even knew where he was.*

*Governor Calvin Rampton at the dedication of the Museum in October 1969, said 'Jennings is a hell of a good politician; he even planted a lobbyist in the governor's bed!'*

Mrs. Rampton was Jennings' former student and an ardent advocate for the Museum.

A real, inspiring character. He died in 1997.



# The 80s – University of Utah

## Part I: The Early 80s – Before Deaning

*Hikes and Friends • The Arsalans – and Four Little Girls! • Prague and IMC – and Choices • TIRF, Wave Guides, and Interfaces • Proteins – Structure and Machines • Teaching, Students, and Theses • Why Not A Pond? – and More • Visitors • The Hladys • Polymer Surface Dynamics • STM and AFM • PEO – Poly(ethylene oxide) • Trips and Travels • Korea in the 80s • Prague Berlin France – 1984 • Entrepreneurship*

## Part II: The Mid 80s – Becoming, Being, Resigning

*Engineering a New Dean • From Being to Becoming and Doing • Kauai • Deaning in Public • The Potsdam Conference, 1985: • Our ‘Daughter’, Nina • Kolff’s 75th • More Deaning • Engineering Ethics – 1986 and 2021 • Deaning – Budgets • Resigning... • Research While Deaning • Consulting and Travels • Recreation and Friends*

## Part III: The Late 80s – After Deaning

*Travels, Visitors, Schools • Tonio, Reed, and Graduation • Marcel Jozefowicz • Pierre de Gennes • On Nobelists • More on de Gennes • de Gennes and the Nobel Prize: • Travels, Tonio, Bordeaux, the Pyrenees • China • Paria Canyon, via Buckskin Gulch • Relocations*

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*and Recruitments – Kopecek and Hlady: • Students, Surfactants, TIRF,  
and Sensors • Mindy • The High Tatras • Pork Barrel Politics • Chair,  
Bioengineering • More Travels • Gradient Surfaces*

## **Part I: The Early 80s – Before Deaning**

### **Hikes and Friends**

JUNE, 1980 WE headed south to meet Dennis, Milly, Shari, and Leigh Ann Olsen at Natural Bridges National Monument – camping, hiking, being. That’s when we ‘discovered’ a tick on Aaron’s head! Discomforting, but no long term effects, we joked. We had been camping a day or two earlier at our 30 acre plot in West Canyon in the Oquirrh, just before heading south. We surmised that may have been when the tick came on board. We soon learned that our 30 acres was only 10 acres – thanks to a real estate swindler. From Natural Bridges it was on to Lake Powell, with the Olsen’s and their little sailboat. We sailed, swam, got sunburned – then we headed north to home, and they headed south to home in Scottsdale, AZ.

July, 1980 was the wonderful Lone Peak hike with Rick and Linda Van Wagenen, Dennis Coleman, Steve Rockhold, and others. We backpacked in, spent the night in a meadow area at about 10,000 feet. Early the next morning Barb and several others returned down the trail. The rest of us continued up and made it to the peak. We hopped on huge rock slabs to the very top, standing on a crooked perhaps 4 x 6 ft slab, with precipitous drops on both sides. It was long, grueling, beautiful. The trip down was fast and tough. I felt the hike for at least a week. I have this great photo of Dennis looking excitedly into the distance

while standing on the very peak. He had recently had back surgery. We joked his surgeon could use the photo as an ad for future patients. Marvelous.

## The Arsalans – and Four Little Girls!

Barb took a strange phone call in August, 1980, but she recognized the voice and the accent from 12 years earlier: Shafiqa Aarsalan, her linguistics classmate from Boulder, Colorado. The Aarsalans were in New York City, having just arrived from Kabul, Afghanistan, via Frankfurt, after a tense escape from Afghanistan to Pakistan. Could they come and visit us – and stay with us for a few days?

“Of course.” Barb answered. “We’d love to see you. When do you arrive? How are you?”

“Good. We are coming,” Shafiqa said.

Then the line went dead. Shafiqa had been calling from a payphone and had run out of time – and coins. No further word. We assumed they’d be flying in, perhaps in a day or two. We knew via the letters that she and Barb had exchanged in the early 70’s that they had a daughter or two. So we waited, a little worried.

Some days later we had a group of friends and foreign guests at our home, for an outdoor buffet, picnic-style dinner and get together. That late August was hot, as usual. I recall Sung Wan Kim and his family, and Mu Shik Jhon, being present. Our home was set far back from busy Highland Drive, via a long unpaved driveway. As I recall Barb and I, and the kids, were busy with our guests. One of us looked up and west, and saw a cab in our driveway. Out poured two recognizable adults, and four unrecognized little girls – walking towards us! The Aarsalans! Shafiqa and Ahmad we knew and recognized – and four more: Mary, Frozan, Mariam, and Humaira – 11, 8, 6, and 4. They had been on a Greyhound bus for 4 days, arrived to the terminal in downtown Salt Lake, and took a cab to 6009 Highland Dr. What a surprise!

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We greeted, laughed, hugged, and adored their four initially shy little girls. We walked them in, did some rapid introductions, and then started to make them feel at home. Our guests understood something very special was happening. The guests left.

We let them wash up, showed the girls their mats and cushions, fed them. We set them up in our larger west bedroom, which also had a loft built in the corner, where the two smaller girls could sleep. Cozy, but very functional.

At first the girls seemed hesitant to be outside. Shafiqa explained to Barb that in Kabul they always had to be indoors, due to the reconnaissance flights and bombing – this was the time of the Russians fighting in Afghanistan.

We took them up Big Cottonwood Canyon, went to Lake Mary, waded and played with floating logs. Later we went to Cecret Lake in Little Cottonwood Canyon – with our red rubber raft. It was a wonderful time to get acquainted and re-acquainted.

Barb baked a birthday cake for Shafiqa, who was turning 40. During our outdoor birthday dinner, I retrieved a small box Barb and I had been storing for about 12 years. We presented it to Shafiqa and Ahmad – a piece of cake from their Boulder, Colorado wedding of 1968! It was their custom to give a piece of cake for storing into the future. We'd been honored to accept it in 1968. We did plan to meet again somewhere after college, perhaps in Kabul.

Shafiqa had a sister in Los Angeles; she also preferred LA weather to the heat or cold of Salt Lake City. So after staying with us perhaps three weeks, they headed for LA – and stayed. We visited fairly often. They have been close friends now for over 40 years.

We tried to get them to talk about the escape to Pakistan. Ahmad had witnessed the slaughter of the then ruling family by a Marxist-Leninist group. Some years later the USSR was invited to help develop the country. The situation later resulted, in late 1979, in the Soviets invading to quell the extensive civil strife. The Russians dealt harshly with Afghans suspected of associations or sympathies with the 'West'. So all those who studied and worked in the USA were known to be on the military's hit lists.

Shafiqa and Ahmad realized they were on such lists – and that they and their family were at grave risk. They very rapidly sold what they could, paid a 'handler' to get them to the Pakistani border from Kabul, with no baggage – just their clothes and some papers affixed to their clothes. The girls had to be very

quiet on the trek through the border region. They made it to Peshawar and on to Islamabad; after some time they made it to Germany, as Shafiqah had a brother there. And somehow they then made it to NYC – and on to us in Utah. Ahmad had nightmares for many years, stimulated by their escape and reliving the anxiety and trauma in his sleep as well as waking hours.

We've been very close friends ever since they arrived on our doorstep in 1980. We would visit them in LA whenever we had a chance. They visited us once in Salt Lake City. We then drove south together with them – visiting Capitol Reef National Park. Tonio's then girlfriend, a young Mormon cellist, also came with us. That was too close; we really weren't encouraging about a Mormon daughter-in-law! We met the Arsalan's once in Mill Valley, CA – a visit to Le and Julian, Barb's parents.

In more recent times, we visit them in November or February – on the way to or returning from our winter retreat in Monterey. In November 2021 we actually did get them to talk about the escape and their stay with us in Salt Lake City:

We had accommodated the entire family in the large bedroom in the new addition to our home. I had built a loft in a corner of the room. Our kids each had their own bedroom as well. Marie and Frozan, the two oldest, recall the loft – and the two younger girls sleeping in it. They also recalled the yard and the rest of the house. They said they'd been advised by Shafiqah to be very quiet and polite, which is why they talked very little. There was also a language barrier, of course.

Shafiqah recalls the girls noticing the ripe plentiful apples on Mr. Nielsen's trees, adjacent to our property. She picked several for the girls. Mr. Nielsen was nearby, walked over, and introduced himself. Shafiqah has a great sense of humor. Rather than saying they were visiting us, and perhaps recognizing Mr. Nielsen's curiosity about 4 dark-skinned little girls, she announced, smiling:

“We're your new neighbors. We just bought this place.”

Later that afternoon, Mazel Nielsen came to the door with a basket of fresh apples and vegetables – to welcome them to the area! Barb explained the situation, and we all had a good laugh.

The four Arsalan girls all work as teachers in the LA School District. Mary has a daughter, Nadia, whom we know well. The Arsalans have remained a very close and cohesive family. Mariam lives in an apartment attached to the family home. The other three daughters each have their own homes, condos.

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## Prague and IMC – and Choices

Milan Houska, who'd been my host and 'guide' in the 1977 and 1979 visits to the IMC in Prague, arrived to work with my group for several months. He really wanted to do total reflection infrared work related to our interface projects. We did have access to the equipment but not to the accessory which was needed. We ordered it, even though it was a big stretch to find the money for it. He spent part of his time waiting for delivery before he could start his experimental work.

He adapted himself to our society. I think it was his first trip to the 'West'. He actually got sick and had to be treated at UTU Hospital. When he left at the end of his stay, I recall him saying:

"The problem with my country is there are too few choices.

The problem with yours is there are too many choices."

I write this 30 years later on the day of Paul Krugman's NYT column:

"Too much choice is hurting America."

Milan was right.

We in America, especially now, are even more inundated by – in my opinion – trivial, useless, unimportant 'choices'. Coffee now comes in dozens of potential combinations. Medical care is complicated by a huge bureaucracy of 'choices' – providers, plans, physicians, lawyers. Purchasing almost anything can involve credits, coupons, codes – and lots of time. The time we don't spend on these near infinite, often useless, choices we then spend on largely trivial, choice-laden entertainment from many semi-competing vendors – more 'choices'. Most Americans today seem to spend little time on thought or deliberation. Neil Postman's words in *Amusing Ourselves to Death* continue to be relevant over the decades – especially the one we are now in.

## TIRF, Wave Guides, and Interfaces

In those days pre-doc and post-doc training grants were popular, although quite competitive. Bob Peterson, Sung Wan Kim, and I, thanks to an NIH proposal via Pharmaceutics, were fortunate in having one funded. This resulted in Monty Reichert, a recent U Michigan PhD, working under Sumner Barenberg, joining us. Barenberg and Reichert (then a PhD student) were pondering the dynamics of polymers and their surfaces in 1979–1980. Their work and interests helped provide a foundation for my own evolving focus on polymer surface dynamics.

Monty worked closely with Rick on TIRF and very quickly developed major interests and skills in the optics and spectroscopy of interfaces. He was soon joined by Jeff Ives and Peter Suci. Vlado Hlady's arrival in the fall of 1983 resulted, together with Rick, in a 5 person focus on total internal reflection techniques for the study of interfaces and – later – for work in biosensors. Doug Christensen, a faculty colleague in Bioengineering, and Joel Harris in Chemistry, and later Bob Benner in EE, also advised and participated.

When Rick and I realized that intrinsic UV TIRF was outside the implied scope of the US Patent by Kronick and Little, USP 3939350, we worked with UU lawyers to submit a patent application in April, 1981. It was awarded in Jan. 1983 as USP 4368047. Our first patent! It covered the use of TIRF for immunoassays without added fluorescent labels: intrinsic UV-TIRF.

After his postdoc, Monty was appointed an Asst. Research Professor, allowing him to accept a Whitaker Foundation young faculty award, and then an NIH New Investigator Fellow Award. The faculty appointment allowed him to take on graduate student supervisory duties. He mentored Peter Suci and Jeff Ives, before going off to Duke University in 1989 for a tenure slot faculty position. Peter finished his PhD in 1988, Jeff in 1990.

We had learned of the work of Swalen and Rabolt at IBM-San Jose on interface optics, waveguides, and plasmon resonance. We learned of Rondelez and coworkers in Paris and others working on interface spectroscopies. We became aware of optical coupling, waveguides, integrated optics, and even surface enhanced Raman spectroscopy (SERS).

Jeff was an avid outdoorsman and hiker. He organized hikes for us. I recall one to Deseret Peak in the Stansbury Wilderness west of Tooele, Utah. He also organized a mild rafting excursion for our research group on the Green River in summer, 1987, starting upstream of Dinosaur Monument. The Kopeceks, Paul Dryden, Jinn-Nan Lin and his wife, and many others participated. Aaron and Tonio joined me on that remarkable adventure.

## Proteins – Structure and Machines

Protein structure was a major interest. I acquired a very new and novel book, *Principles of Protein Structure*, in 1979 – by two young German biochemists. It opened up the world of proteins as ordered, organized, specifically functional devices – even machines. It served as the initial foundation for our work on protein behavior at interfaces, including the concept of domains and sub-structures.

The work of Richard J Feldman at NIH on means to actually see and project the 3-D structure of proteins came to my attention. He and David H Bing at Harvard developed and distributed TAMS: Teaching Aids for Macromolecular Structure in 1980. It was a kit of stereo teaching slides with a collapsible cardboard 3-D viewer, to display the 3-D structure of proteins for which the full 3-D x-ray crystal images were available. Absolutely breathtaking!

Interactions with Kay Ely and Jim Herron, working in Allan Edmundson's group in Biology, catalyzed my interests in antibodies, fluorescent labels, and immunoassay. I recall a Bioengineering Seminar by Kay, titled One Protein, Four Conformations. It opened my eyes to the complexity and versatility of protein shapes, dynamics, specificity, and flexibility – which we, in turn, applied to our own concepts about polymers and their interfaces. Jim started helping us with antibody-based concepts and experiments, getting involved with the TIRF work. He joined the Pharmaceutics faculty in 1987. His expertise in antigen-antibody binding and specificity helped lay the groundwork for our future work in biosensors.



The structure of antibodies was described as a domain approach to structure-function. In a Y-shaped IgG antibody molecule, the arms of the Y were called the Fab regions – they bound to the molecular antigen to which the IgG was specifically tuned. The Y tail was called the Fc region, C for Complement, a set of proteins involved with the activation of inflammation. The specificity of IgG and its ‘sister’ but five times larger IgM antibodies were rapidly worked out and becoming well known – laying the ground work for a domain approach to all areas of protein function and structure. I was enthralled. Discussions with Kay and Jim and others set us on a productive direction for understanding and controlling protein adsorption.

In May 1981 I attended a ten day workshop on Biophysical Aspects of Immunology, run by Ruth Arnon (one of David Rose’s friends in Israel). The event included tours and excursions to the Jordan River, Sea of Galilee, Golan Heights, Jerusalem, a kibbutz, the Lebanese border, and nearby sea caves. I also visited Sid (or Sol) Seidman of the Technion, in Haifa, a colleague of Kolff’s and an internationally known bioengineer; then it was back to the Weizmann Institute to see Alex Silberberg, a key theoretician on polymers at interfaces.

In 1981 I was honored with the UT Distinguished Research Award, together with Robert Smith of Yellowstone supervolcano fame, and Carl Durney – the quiet, creative bioelectromagnetics pioneer. Carl died in late 2021.

The early 80’s brought new opportunities, new collaborators, and a major book project – and Carl Sagan’s *Cosmos* on PBS. *Cosmos* was not just a science show – it was Sagan’s testimonial to curiosity, to questioning, to science, and to learning. He subtitled it *A Personal Voyage*, and began the series with the simple statement ‘Come with me...’. Brilliant and effective.

*Cosmos* was a major stimulation to my interests in fostering public awareness of and literacy in science. Carl Sagan became one of my heroes in the *Science without Walls* project in the mid-90s. He died in late 1996.

# Teaching, Students, and Theses

Teaching was a major part of my duties and time, including undergraduate courses in MSE and Pharmacy.

A range and variety of graduate students worked with me. In 1980 Robert King finished his PhD work and began working at a local diamond products firm. Bob's work included establishing our ESCA lab and service analysis facility, and working on an artificial tendon with Harold Dunn. His thesis provided a firm foundation and blueprint for our work on surface characterization of bio-materials for the next several decades.

Sacha Hattori and Bob became an 'item' and soon married. Sacha finished her work – also in 1980, working with John Hibbs studying fibroblasts and other cells interacting with methacrylate-based polymer surfaces. Bob and Sacha moved to the Bay Area as I recall, and later divorced. Bob ended up in the LA area, remarried, and then went to Colorado. We haven't stayed in touch. We have stayed in touch with Sacha, who lives in Sunnyvale. For the past several years she has visited us in Pacific Grove, driving her white Miata.

A third 1980 grad was Dennis Coleman. After he'd completed an msc degree working on the Foreign Body Reaction, he developed a multi-paramater approach to the study of blood-materials interaction (BMI) as his PhD work. With Bob's surface characterization protocols, and Dennis' BMI protocols, we were in a strong position to develop and test various hypotheses for BMI. And we did. The multi-parameter approach to the complex BMI challenge served us well. We went on to apply multi-variate thinking to protein interactions with surfaces.

Our work helped fuel an interest at NHLBI to develop reference materials for BMI studies. We encouraged that program and insisted on multi-variate approaches to all aspects of characterization and testing. Some of those grantees became our 'customers' for surface characterization services.

Other 1980–81 work and theses include Barbara Zdasiuk's on protein adsorption via TIRF, Phil Triolo's on catheter surfaces, and two Mormon 'boys' studying fibronectin and insulin – Stoker and Quinn. Zdasiuk died in an auto

accident days after defending her msc work, and a day before her Toronto wedding day.

Stoker and Quinn were very interesting. They were classical high-achieving, directed, driven Mormon boys, who wanted to get an msc. degree within 12 months. I told them that, although that was an unrealistic goal, I'd do all I could to help them. A problem was that they were 'believers' – not critical thinkers. They had great difficulty questioning, challenging, criticizing their own work and results – and of course the work of others. They especially wanted to believe everything I told them – and what other 'experts' and mentors told them. They did finish in 'record' time with credible msc. theses some months after their self-imposed 12 month time frame.

Phil Triolo worked for a time at Research Medical, founded by Gary Crocker, who was negotiating with Abbott, a large medical products company, to buy Sorenson Research. Crocker and his Harvard MBA apparently impressed Abbott, securing a premium price for Sorenson, and catapulting Jim Sorenson, almost overnight, into being Utah's richest businessman. Gary Crocker was Sorenson's son-in-law!

Phil went on to work in Ian Feijen's lab in the Netherlands for two years, returning to UTU and finishing his PhD under Sung Wan Kim in 1988. He has been in private practice in SLC since then, consulting with and advising firms on Federal regulatory issues and matters.

In late 1983 David E Dong finished his PhD work in Pharmaceutics on lipoprotein adsorption – and then went on to medical school. Mark Davis did a msc on catheter surface property modification. Jie Chen extended our work on hemoglobin adsorption, for a grant I'd received titled 'The Hemoglobin Hypotheses'. That work was initiated by Jon Pierce, who did his msc. in 1982.

Our extension from TIRF to fiber optic sensing began about 1984 with Karl Newby's msc work, wherein he removed the cladding from the tip of an optical fiber and used it to detect fluorescence from dyes and labeled proteins.

## Why Not a Pond? – and More

Barb always wanted a pond. Much later she'd get a roaring creek, but we didn't know that then. A pond with lilies, ducks, fish – right outside our dining area window. Why not? I was busy and thus not too eager, but she and the kids got to work. They began digging – for a long time.

Several years later we had a static pond, then worked to install running water, a tiny stream, and a little waterfall. By 1982, she wrote to her high school friend, Marilyn Bruner, we did have a functioning pond with a small waterfall! We then got professional help, and by early 1987 had a full, functioning, lovely, dynamic recirculating pond – with fish, occasional ducks, lots of birds, and lilies. Beautiful.

In late 1980 Le and Julian Williams celebrated their 40th wedding anniversary. Tonio was in Junior High at this time, and Aaron was enrolled in the Open Classroom. Le Rose worked part time at the Mill Valley Public Library, just down the road from their home, continuing her various art activities. In Fall, 1982 Barb's younger sister, Antonia, married Paul Manda in Chicago and continued living there until they relocated to Portland, Oregon. In Fall, 1984, a very pregnant Antonia, and Paul, were hiking with us in the local Wasatch Mountains, some months before Lucas was born.

In 1981 my father suffered a heart attack and was hospitalized. My Mom retired in early 1983 to care for him at home. In early 1983 he was seen by a Dr. Cheng, a heart specialist who had ordered various tests and was following up his condition. He died Oct. 23, 1983 at 62 years of age. The death certificate records Ventricular Fibrillation due to severe congestive cardiomyopathy. I was at a conference in Wisconsin when I received the news.

## Visitors

We had many visitors. I enjoyed inviting people who were doing interesting work, perhaps relevant to our interests. We also had access to nearly all those

who came to meet and see Kolff. I would also invite myself on to the schedule of interesting visitors invited by and hosted by other departments. Barb and I would introduce many of them to hiking in the local canyons and to meals at our home.

I probably met Marcel and Jacqueline *Jozefowicz* at a Biomaterials Society meeting somewhere. They were a lovely, fascinating, and exciting couple. He did much of the speaking – an eager, excited, dynamic, and expressive scientist. Jacqueline was quieter, stood by her man, but also corrected and tempered Marcel when necessary. He would be at the lectern, talking away, presenting a seminar, pointing and gesticulating at his slides, and then – from the audience – quietly but firmly, Jacqueline would say:

‘Marcel, that’s not quite right. It’s ...’

He would stop, look at her intently, think, and often respond:

‘I love you, Jacqueline! You are right, of course.’

He’d blow her a kiss – and move on with his now slightly amended presentation.

They were delightful. They visited SLC in 1985 and 1989.

Another important visitor was Hans Lyklema from The Netherlands. He was one of the world’s experts on surfaces and interfaces. He was quite a walker, so Mu Shik Jhon (who wasn’t a hiker) and I took him to Mill Creek Canyon and its Grandeur Peak trail. Mu Shik Jhon quit at the top of the Church Fork portion of the trail, perhaps staying there with the students accompanying us. Hans and I kept going. I doubt we made it to the peak as we were concerned about Mu Shik. Lyklema loved it. Thankfully, it made his visit even more memorable than it already was via learning and seeing TIRF, thanks to Rick, because ...

## The Hladys

...in May, 1982 I received a letter from a Vladimir Hlady in Zagreb, Yugoslavia. He was an Assistant Professor at the Ruder Boskovic Institute with a desire to work in the USA, probably on a Fulbright Fellowship. He had worked with Lyklema, studied albumin adsorption, and would likely provide his own

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funding for a year. Vlado had recently visited Lyklema in Wageningen Univ inquiring about new areas of surface science; Lyklema suggested he look at the TIRF work at the UU. Although I didn't know of Boskovic, or where Zagreb was, I knew Lyklema and liked Vlado's work. Vlado looked at us, we looked at him. He received the Fulbright, we made arrangements, and he and Milena appeared in Salt Lake City (SLC) in Sept. 1983, just months after I'd become a very busy Dean. They recall my meeting and welcoming them on arrival at the airport, then depositing them at the Charleston Apartments, near the UU. I then left town!

They were isolated, on a weekend, in semi-dead Salt Lake City.

Milena would later recall:

'We're not in Europe anymore!'

Shortly after they settled in Barb and I visited with them in their apartment and on the roof of the Charleston building – with a great 360 degree view. Vlado had a short wave radio set up, which impressed me, as I'd had one in Denver and as a kid in Decoto, California. I enjoyed trying to tune in foreign stations. Even more impressive was Novo Fosili, a popular Croatian pop music group which they liked. They played the group's new song Moya Milena, which seemed appropriate. I liked their sound and acquired their tapes on future visits to Zagreb.

In addition to the deadness of SLC, they were quite concerned about our earthquakes. Their 6th story apartment was located right on the Wasatch Fault! To prove the point, they experienced a Richter 4.5 whose epicenter was near the airport (Oct. 9, 1983). They also experienced, just 2–3 weeks later, the south central Idaho big 6.9 quake on Oct. 28, which we all felt in SLC. Fortunately, then the Fault took a rest.

What a Godsend! – a most remarkable, talented, creative young surface scientist came to our lab, on a Fulbright fellowship. Vlado and Milena have been dear and close friends ever since.

Vlado and Rick worked together expanding and further developing our TIRF studies into the much more experimentally demanding area of intrinsic ultraviolet fluorescence. TIRF became a mainstay technique for us into the 90's. Vlado worked with us for two years, they then returned to Zagreb in 1985. We visited and interacted for the next several years. He and Milena returned in 1988 and stayed. The rest of his creative career has been at the UU.

Later I learned that Vlado played bass guitar in a well known Zagreb-area band called Biseri (Pearl in Croatian). Vlado and Milena had already met, I think, but reconnected during a band concert on the island of Hvar.

## Polymer Surface Dynamics

We knew from our surface characterization studies of hydrophilic polymers that their surfaces were complex – and time and environment dependent. That led us to more fully develop so-called underwater contact angle methods for characterization of such surfaces – receding contact angles were generally much lower than advancing ones. Some of this flexibility could be probed by inverted contact angles in water, using air and octane bubbles (drops). Lee Smith developed equipment to study such geometries. The flexibility and responsiveness of those soft interfaces was responsible for much of the common hysteresis phenomena commonly observed.

About 1982 Plenum Press suggested I develop a book for them. We decided to title it *Surface and Interfacial Aspects of Biomedical Polymers*. After considerable thought and discussion, it became a two volume project: Volume 1 is subtitled *Surface Chemistry and Physics*; Volume 2 is *Protein Adsorption*. It was finally completed in very late 1983; both volumes were published in early 1985. Members of my research group and many of our collaborators provided most of the chapters. I was also fortunate to secure chapters from active and current scientists doing novel and pioneering work for both volumes.

Our ideas, focus, and work on the dynamics and environmental responsiveness of polymer surfaces, outlined in a chapter in the 1985 Plenum book, expanded via a June, 1986 regional meeting of the American Chemical Society. That resulted in another Plenum book, *Polymer Surface Dynamics* in 1988. I noted in the Preface that “...polymer surfaces are indeed dynamic and undergo time- and temperature-dependent relaxations in response to changes in their local environments.” We went on to discuss and study ‘intelligent surfaces’ and even later, with Jozefowicz in Paris, the concept of ‘statistical specificity.’

Although these concepts were new to me in the late 70's and 80's, they were, in part, well known in the industrial surface chemical literature, including us patents. I learned in the late 80's that the 3M Corp. had a set of patents from the 1960's dealing with the reorientation of polymer surfaces to their environments, including the effect of detergents in washing, and reorganization-restructuring (and pressure dependence) for tapes and adhesives applications. Later I would consult for 3M.

## STM and AFM

As Hoffman and Ratner built their program in Seattle, I participated in visits, briefings, and meetings at the U of Washington. During one of those meetings Buddy Ratner gave an enthusiastic update on a very new method for ultra-high resolution imaging of surfaces: Scanning Tunneling Microscopy (STM). I was fascinated. I learned that a Stanford professor, Calvin Quate, had collaborated with the developers of STM, who worked in an IBM lab near Zurich. The two IBM researchers received the Nobel in Physics in 1986, thus propelling STM into the science mainstream. I soon contacted Quate.

Chen-ze Hu had joined my group in 1985. We had done some work earlier on the surface analysis of pyrolytic carbon, an aerospace material being evaluated for implant applications. Chen-ze became interested in making a type of such carbon by the pyrolysis of a polymer, polyimide. Chen-ze was very interested in STM, so we worked via Calvin Quate to do some preliminary studies in his lab at Stanford. They were quite promising. We contracted with Quate's recent student, DPE Smith, who had set up a 'garage shop' firm, the Tunneling Microscope Company. We received one of his first units, thanks, as I recall, to funding via our relatively new Center for Biopolymers at Interfaces. Dr. Hu stayed on as a postdoc to set up and use the microscope, supervising the early work of Li Feng, starting in 1988.

Hu and Li Feng, as well as Jinn-Nan Lin, immediately started to work on STM. That rapidly led to our interests in SFM, Scanning Force Microscopy (also called atomic force microscopy – AFM). That led to contact with Paul Hansma



at UC – Santa Barbara and to our acquisition and involvement with the dynamic new field of AFM, proteins, and materials.

Rick and I continued the work on TIRF for protein adsorption, moving into the ultraviolet to use the intrinsic fluorescence of tryptophan in proteins. We first noted this in several abstracts in the early 80's; full papers followed through the 80's. The problem was light scattering from imperfections and dust. The scattering is much stronger at low wavelengths than at the higher ones used in normal visible fluorescence and in the infrared. That required an excellent spectrometer to filter out the scattered light, permitting only the fluorescence emission to be detected. The problem was similar for a then esoteric method called Raman Spectroscopy. So we learned about high quality optics and monochromators from the Raman community. We even dabbled in surface and surface-enhanced Raman Spectroscopy (SERS).

I can still clearly see our new Jobin Yvon monochromator, topless, in our pitch dark lab separating the spectrum in space. Beautiful. We had removed the top cover so we could peer in and watch the light separate at high resolution.

Monty Reichert got very involved in plasmon coupling and waveguides. He visited Swalen in San Jose to get hands on experience on variable angle coupling and integrated optics. Working with Jeff Ives and Peter Suci, they applied Swalen-based methods to our own work on surface characterization and protein adsorption

After his PhD Peter Suci went to work in Paris with F Rondelez, Jeff Ives stayed in industry, and Monty accepted a permanent position in bioengineering at Duke.

We realized that optical fibers transmit light via internal reflection modes, and that an uncoated, unclad fiber would function as a TIRF sensing surface. Others thought similarly, especially Tomas Hirschfeld and Myron Block. Tomas was a brilliant, very obese, optics obsessed researcher, originally from Uruguay. I hosted him for a talk at the UTU, probably in the early 80's. We walked from the Engineering Building to the 3rd floor restaurant on campus, called the Panorama Room. We walked slowly, due to his weight and the unaccustomed 4500 feet elevation. We were to meet several others for lunch. I was scared to death he might collapse. He was sweating profusely, but gamely, slowly, walking on. We made it, but I made a mental note to be especially careful with very overweight and out of shape visitors to our elevated campus. I just

couldn't imagine trying to give him CPR! He died at age 46 in 1986. I recall some time after he died that I asked the Lawrence Livermore Lab (LLL), where he had been working, about his videos and tapes. They sent me a small package, which Vlado and I studied.

I was doing a lot of traveling – conferences, seminars, advisory groups. In fall, 1982 I participated in a workshop at Battelle Memorial Institute (BMI) in Columbus, Ohio, probably discussing TIRF. The group at BMI was quite expert in applying infrared spectroscopy to the study of proteins at interfaces, as Don Lyman and Kris Knutson were doing in Utah. I met a BMI staffer, Suzanne Winters, who indicated an interest in graduate work in Utah. We talked, she came, and we began working on polyethylene oxide binding and characterization. It was on one of her first Mt. Olympus hikes that she realized she should see a doctor, finding that she had a small septal defect in her heart; she had it fixed.

## PEO (Polyethylene Oxide)

In the late 70's – early 80's there was great interest in PEO as a blood-compatible surface, including much very basic and theoretical work. PEO interfaces fitted my minimum interfacial free energy approach. This was made even more interesting by a paper by Merrill and Salzman, 'Polyethylene Oxide as a Biomaterial', in late 1982. Suzanne started working with PEO as a means to immobilize the anti-coagulant, heparin. This was of interest to sw Kim in Pharmaceutics. Suzanne worked closely with Kim and his team, and did her graduate studies and PhD degree in the Dept. of Pharmaceutics.

PEO (also called PEG, for polyethylene glycol) is a synthetic water-soluble polymer widely used to adjust the viscosity and drag reduction properties of solutions. PEO solutions were also used for the purification and even crystallization of proteins for further study. The polymer-drug community (Ringsdorf, Kopecek, sw Kim) were interested in small PEO molecules as spacers and tethers for drugs attached to polymer surfaces, including medical devices. Smaller PEO molecules were the components of surfactants and even detergents, as well as incorporated as segments in block copolymers, including polyether

urethanes – the polymers focused on by Lyman and Ratner. We went back to our ideas on water structure and considered water-PEO interactions and interfacial energetics. We examined PEO surfactants as a simple means to treat surfaces for short-term application as protein-resistant and blood compatible surfaces.

The field was summarized in a 1992 book by J M Harris in which we had several chapters.

This experience was further developed by Jinn-Nan Lin into the area of immunosensors.

## Trips and Travels

Barb and I drove to the South Rim of the Grand Canyon in May, 1984. We'd always wanted to hike to the bottom and spend the night at Phantom Ranch, a rustic lodge operated by the Grand Canyon National Park. I assume we made reservations in advance. Today you make 'reservations' via a lottery 15 months in advance! It was wonderful. We ate in a large communal dining hall and slept in a men's and women's dormitory. Kids? They were 14 and 16, so I guess we left them alone.

While on the grounds, Barb stopped, opened her backpack, pulled out a bottle of Portuguese white wine, Aveleda's Vinho Verde, as I recall, and two glasses! Really. We toasted ourselves, marriage, the kids, Utah. She'd hauled them all the way down the trail the day before. A precious time. Perhaps then we started thinking about an annual Anniversary Adventure, although we didn't really start the adventures for another 20 years. On the climb back up we took in the small signs that informed us of the geologic ages we were 'passing' through – from over 2 billion years ago to the present – my first real exposure to and interest in geologic time.

Delta Airlines launched its Frequent Flyer (FF) Program in 1981. We almost immediately enrolled. I can't recall when I achieved Million Mile status, perhaps in the mid-90s due to lots of foreign travel, perhaps even earlier. Most airlines followed suit, so we soon had FF accounts with each of the major airlines.

## Korea in the 80s

Six more trips to Korea from 1980 to 2001. Barb went on only one additional trip with me, to Cheju Island for sw Kim's 60th birthday celebration in 2000.

In 1980 I lectured and discussed at KAIS and KRICT (Korean Research Inst. for Chemical Technology) in Seoul as well as in Pusan again. We had a men's night out with Y.K. Sung's Department chair, who introduced me to *soju*, a vodka-like Korean alcohol, which I really liked. I managed to buy some when back in Seoul at a very local convenience store, near the KAIS campus and nearby museum.

The Seorak Mountains just north of the 38th parallel were the highlight of my third trip to Korea in May, 1981. Sung Wan and Hee-Kyung Kim, and Mu Shik Jhon, took me across South Korea in a large black Mercedes sedan to the East Coast. As we drove North along the East Coast from Gangneung we stopped at the 38th Parallel. I was told that soldiers examine the sand every morning looking for tracks of North Korean defectors or saboteurs who may have entered during the darkness. Interesting. We then drove North to Soroksan National Park, just south of the present border with North Korea. The Kims, and Mu Shik, knew I loved the Wasatch and thought I'd enjoy an excursion to their beautiful Wasatch-like mountains. I did. We hiked many trails, including one to a high ridge where I looked towards North Korea. There was a drought at the time, so we missed seeing the usually plentiful streams and waterfalls.

Back in Seoul I gave a multi-day basic course on ESCA, preparing a single overhead transparency on a long continuous sheet. It was like writing a scroll. Preparing the ESCA lectures provided the foundation for my own education and for the later chapter on ESCA in the 1985 Plenum Press book. I think that was the trip where I found my own book from the Hydrogels conference in the KAIS bookstore, a locally photocopied and bound 'pirate edition'. Cool.

Daejon/Taejon, south of Seoul, was the destination in 1986, to see HB Lee at KRICT. As I flew KAL from San Francisco to Seoul via Anchorage, I couldn't help but think of KAL Flight 007 (NYC to Seoul) – it had been shot down by a Soviet air-to-air missile on Sept. 1, 1983.

There was a conference in Daejon. I recall a very social dinner with sw Kim, Allan Hoffman and others. Sitting between Allan and me was a young

Korean woman in a bright red dress – the hostess companion for our ‘meeting’. It was normal to have a young hostess to be attentive to guests. One time I was hand fed via chopsticks by one such hostess. Although I had initially declined, I finally succumbed. But in 1986 Allan was especially taken with our hostess. They snuggled a bit. We were sitting on an upholstered bench. Allan’s hand was placed on the bench – and slowly moving towards our hostess’ derriere. I do recall clearly one such excursion, as my hand was also on the bench, also a bit extended. I felt a hand beginning to explore and caress my hand. As I explored the migrating hand, the top of it was rough, not ultra-smooth, as expected for a young hostess. I finally realized the situation, gently pinched the vagabond hand, and Allan’s old hand reared up in the air. We all had a semi-inebriated laugh, including the hostess. Never again did I hold hands with Allan Hoffman. He was always a good sport.

## Prague Berlin France – 1984

The Institute for Macromolecular Chemistry (IMC) in Prague hosted another IUPAC conference, July 9–12, 1984, on Medical Polymers: Chemical Problems. We decided to go – all four of us. The boys were 14 and 16. We were hosted in part by Henry Kopecek with Pavla Reymanova’s assistance. They weren’t married yet. We visited castles, monuments, and many other sights. Pavla took the boys to her family cottage in the country, where Aaron lost his glasses, while Barb went on a conference ladies excursion. I participated in the IUPAC meeting. It was likely this visit when Henry and I began more seriously discussing the possibility of his relocating to Utah. I was now a Dean with some authority and resources – we could make it happen if that’s what he wanted. We must have left Prague just before the conference ended, because – towards the end of the trip in Paris, visiting the Jozefowicz – Aaron’s glasses were returned to him. Pavla had found them and sent them on to us via Marcel Jozefowicz!

After Prague there was an international Artificial Heart meeting in West Berlin, Artificial Heart II, organized by H Bucherl. Lee Smith recalls that the Utah nuclear-powered artificial heart project, on which he was working, was

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presented and discussed. I participated in the materials session; Smith, Jarvik and Olsen also participated. We Andrades flew from Prague to East Berlin via Czech Air (known as OK Airlines). I recall a plane with canvas seats. The flight was uneventful.

Landing in East Berlin was fascinating. We were ushered off the plane directly onto a bus with other Westerners headed for West Berlin. I recall the airport and East Berlin as dark and drab. The bus took us toward the West Berlin gate via a fairly narrow road, in a residential-like area. I don't recall anyone boarding or asking for ID, passports, etc. That was probably done back when leaving the plane. As we passed through the border into West Berlin, it was like that scene from *The Wizard of Oz*, when the film transforms from black and white to color ('We're not in Kansas anymore.'). The West Berlin houses were tiny, compact – and colorful! There were potted flower boxes on the little porches and yards. From East to West was a definite visual discontinuity. We ended up at the International Hotel, a glitzy convention hotel where the conference was held.

We were close to the Berlin Wall and Checkpoint Charlie. I recall going out with Lee Smith and Tom Kessler, after some drinks, and visiting – touching – the wall – and looking over it to the East Berlin side, across the barricaded defensive strip. Lee recalls being at the wall in the evening, after drinking German beer, and needing to urinate. He approached a foresty area near the wall to do his business – and floodlights went on. He got out of there quickly.

Nearby was the Checkpoint Charlie museum, The boys and I visited and were fascinated by the vehicles, tools, and tricks used by East Germans trying to escape into West Berlin – most were unsuccessful. Failure was, of course, lethal. I bought two books on the museum that were also fascinating. I still have them. It was a very significant experience for the three of us.

Then on to Paris to work briefly with Marcel and Jacqueline Jozefowicz, the fascinating husband-wife scientific team. I think on the same trip we visited the Sweeneys in Lewes, England for a few days. They were there for a month or so. The kids enjoyed Bob's enthusiasm for golf – and his lessons. Book and record shops were a special treat.

We also visited the Hibbs in Lautrec, France on that same trip, July, 1984 (or maybe we saw them just before going to Prague?). Lautrec was near Françoise's family home in Garrott, near Roquercourbe. A long, wonderful trip.

## Entrepreneuring?

In the early 80's Sung Wan Kim and I joked that we should stop free consulting and advising for the many Japanese delegations that came through, wanting to visit labs and to learn of our latest work. So we, initially kind of as a joke, printed business cards that read Biomaterials International, Inc. (BMI), Kim and Andrade, consultants. We would hand out the cards when asked too much about our work. I don't think it stopped any future visits. We did take BMI seriously when Jim McRea finished his PhD work under Kim's supervision in 1981. We 'appointed' Jim as President, Lee Smith as VP, Kim as Board Chair and CEO. Dennis Coleman, Rick Van Wageningen, and Don Gregonis were also involved. I had very little to do with the effort, but it was a great introduction to entrepreneuring, which was becoming quite popular at the UTU and within the State.

BMI's first product was the Lee Smith creation of apparatus for contact angle hysteresis measurement. It was called Wet-Tek – a dynamic Wilhelmy plate method to measure surface energetics. BMI may have also sold a few of the rotating cell adhesion device Lee developed and used in his thesis. BMI later morphed into Albion Instruments, which was later sold to Ohmeda Corp.

## **Part II: The Mid 80s – Becoming, Being, Resigning**

### Engineering a New Dean

As my academic work and development continued, and after being promoted to professor, I started to become interested in administration. In 1978 I agreed to serve as Chair of the relatively new Department of Bioengineering. The founding Chair, Curtis Johnson, had died, unexpectedly, of stomach cancer.

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The charismatic and colorful Larry Lattman had been Dean of the College of Mines since 1975. He was appointed Dean of Engineering in 1978 by Cedric Davern, then vice president for academic affairs under President David P. Gardner. Davern had asked my opinion of Lattman. I told him that I thought Larry was a good dean of Mines and might be good as dean of the combined colleges of mines and engineering. There had been some interest and talk for several years about merging the two colleges. Lattman was indeed appointed and became dean of each college though he did not pursue a formal merger.

This was a time of state budget cutting and it was rumored that the UU, including its College of Engineering, would take a substantive hit – in the range of 7 to 10 percent of its total state budget. There was talk about which departments would be ‘targeted’ for decrease or even elimination due to ‘financial exigency’. During a Bioengineering faculty meeting, which I called and chaired, Lattman was invited to discuss the state of the college’s finances. He not very smoothly addressed the impact on Bioengineering by saying something to the effect of ‘Contrary to what you may have heard, I have no intention of eliminating Bioengineering.’

We all looked at each other. I had no idea he was considering sacrificing Bioengineering – perhaps Civil, or Industrial, but not Bio-. At the time Bioengineering was a graduate-only program. We had no undergraduate students, thus our enrollment numbers were ‘low’.

I suddenly developed a stronger interest in the thoughts, perceptions, and potential actions of Larry Lattman – and perhaps a motivation to serve as Dean of Engineering.

Lattman, in my opinion, was doing little – serving mainly as a ‘caretaker’ dean. He did not address the merger of the two colleges, he had no real initiatives. I became more and more critical. I assumed he might be receptive to moving up – administratively. Although a generally nice guy, I understood he had a strong ego. I began sending him – anonymously, via Campus Mail – clippings or photocopies of ads and postings of searches for President. This went on for a year or so.

One of the ads I sent was for President, New Mexico Institute of Mining and Technology. There was some talk of his looking, and then in 1982–83, his acceptance of the Presidency at New Mexico Tech was announced. He served



in that position for the next ten years. I don't know if my clandestine campus mailing of job ads helped, though I like to think it did!

My interest in succeeding Lattman as Dean was already known to Associate VP Davern, based on our earlier discussions in 1978. I had been reading about academic leadership – or the lack of it. I enjoyed the 1982 business bestseller *In Search of Excellence*, especially the profile on Hewlett-Packard (HP). I loved the strategy of MBWA – Management By Wandering Around.

Davern and I talked again. I was appointed Dean effective July 1, 1983, via a letter from then President, David Gardner. The month before I had met with each individual faculty member (about 75) – in their offices – to get their input on the College's needs, wants, resources, and potential – to help develop a vision and plan for the College. There were several who, although very cordial and polite, did not consider me a 'real' engineer. Real engineers are in the 'classical' disciplines of Mechanical, Civil, Electrical, or Chemical. Neither Materials Science nor Computer Science did Engineering – they did science. And as for Bioengineering, ...

We had several critical issues to address in addition to budgets: over-enrollment, teaching and research space constraints, and the need to better work with local industry and the university community. Later, I gave each Department Chair a copy of *In Search of Excellence*.

In August, 1983 Gardner left to become President of the University of California system. Chase Peterson became the UTU's 11th President in Fall, 1983; he replaced his VP, Cedric Davern, with Irving (Irv) Altman, a Professor of Psychology. It was traditional for all deans to submit their resignations when a new higher administration is installed (President and Vice-Presidents). But as I'd only been dean for several months when Chase and Irv took office, I just carried on. I probably would not have resigned if they had asked me to.

## From Being to Becoming and Doing

Even before July 1, as Lattman was already gone, I began to move in to the Dean's Office, located nearly on top of the Mechanical Engineering Department's nuclear reactor! Marvel Leader, the office administrative assistant, was a bit taken aback by my 25 or so 4 drawer filing cabinets and the large number of intimidating Euphorbias placed on top of them. I needed the files for my research and teaching – and continued meeting regularly with individual students in the Dean's Office (space was precious; we had no interest in ceremonial, dual, or minimally used offices). We had a stock of folding chairs in the corner, which enabled us to accommodate up to some 20–25 people in the office.

I had developed an interest in latex-producing plants, the result of hearing a lecture by Melvin Calvin some years earlier. Knowing this, Barb's Mom, Le Rose Williams, kindly gave me a set of Euphorbia. Marvel was initially appalled – cacti!, folding chairs, dozens of filing cabinets – not appropriate! I also had a big clock prominently visible – set about 7 minutes fast to help me finish meetings on time and stop overly loquacious 'debate'. Very effective.

Engineering was generally in the news due to the national interest in entrepreneurship and economic development. Former Dean Wayne Brown had worked with the us National Science Foundation to establish an Innovation Center in the uu Research Park.

University of Utah President David Gardner chaired and had just submitted a very influential national report: *A Nation at Risk – The Imperative for Educational Reform*. The report had a strong effect on me. I became interested in the Hansen Planetarium, the small 'science center' in downtown Salt Lake City. I was later asked to serve on its Board and participated in the Board's discussion and plans to develop a real, comprehensive science center for Utah. Hugo Rossi, Dean of Science for uu, also served on the Board. That all led, eventually, to The Leonardo (Chapter 10).

The College received little real support from local industry. I asked around as to what support from industry was reasonable to expect. I learned of an alumnus who was doing fundraising for MIT. I invited him, he came, we talked. He

said that a Dean of an Engineering school which produces the technical people power for a major urban area is very important to industry. Being Dean gives me a standing comparable to a Congressperson or major corporate president. I should be able to call, request a meeting, and expect a prompt, courteous, and successful response. So I did. Often.

We realized that engineering programs in other states were being endorsed, supported, and promoted by industry and by some state governments. We set up an Industrial Affiliates Program and a major Industrial Advisory Board. The Board was designed to provide vision, perspective, and advice. The Affiliates was a membership program designed to generate money for faculty research and to exchange information and technology with local business and industry. These followed the national trend being encouraged by the National Science Foundation (NSF).

I worked hard to develop interactions with the local community, especially the news media, the Legislature and the Governor. We developed a Faculty Research Directory, with brief research profiles for all academic, research, and adjunct faculty in the College. I found the funds to hire a Community Liaison assistant, initially Mr. Guil Funston; later, in early 1986, it was Dr. Peter Gerity, as Assistant to the Dean for Community Interactions.

We contacted alumni, encouraged donations, and generally developed the College's first significant fundraising effort. Walter Doyle, a retired executive of Texaco Oil, and Ray Beckett, friends and colleagues of Gerity, also assisted. They and Peter were very effective in generating private support for college faculty research activities. Dr. Mark Heritage, who was on an executive sabbatical from IBM, also joined the Dean's Office team.

I worked hard to visit local industries to solicit interest in – and support of – engineering. Effective entrepreneurs and industry leaders were generally receptive – and I learned much from nearly every visit, although the effort didn't earn much for the College.

At a visit to the local iOmega Ogden area plant for reuseable floppy discs, a big breakthrough at the time (the Bernoulli Box, the Zip Drive), I saw a motivational poster titled *Followup*. The line below, in a slightly smaller font, said *Followup*, so did the next line, and the next. Some 30 lines down the poster ended with a tiny font: *followup*. Good advice, that has stuck with me to the aged present.

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It was a time, I argued, for the College to go beyond being a very traditional, in my opinion not very interesting, set of programs. I wanted to facilitate joint appointments – to encourage interaction between departments – even across campus between colleges. I learned that I could skim a bit off the top of the roughly \$20 million College budget; a 0.1% skim would generate \$20,000 – that was significant. I directed that initial skim to Bioengineering to fund a joint appointment with the College of Pharmacy – an unheard of plan. My strategy was to do similar deals with the Colleges of Science, Health, and perhaps others.

As I was visiting with each faculty member individually, one on one in their own offices, to solicit advice, I was told by one that I could save time, in the case of Chemical Engineering, by just talking with one of the chemical engineers:

‘They all eat their bag lunches together, they think all the same; it’s just one voice.’

I’m afraid that, at the time, his statement applied not only to Chemical but to Civil, Electrical, and Mechanical Engineering as well. That needed to change.

Those four Department Chairs were, in my opinion, ineffective in leading their programs. They were quickly replaced. I also reviewed new faculty offers and hires to minimize too much business as usual thinking. In one case I rescinded an offer from our Dept. of Mechanical Engineering to someone who I felt would be too traditional. That almost got us into trouble with the new Engineering Director of the NSF. I learned later that I had rescinded an offer to one of the Director’s own graduate students! The ME faculty was outraged, especially its normally quiet chair, Bob Boehm, who later left in protest to accept a position at U of Nevada – Las Vegas. I was a bit shaken by his resignation, as he was at the time the only person in Mechanical Engineering with awareness of and interest in solar energy.

I facilitated several hires that proved to be bad actions. I hired ineffective new Chairs for Materials Science (Joel DuBow) and Civil Engineering (Sam Ghosh). In both cases, years later, each had to be urged out of the University. I had to deal with a serious case of student plagiarism by a tenured professor of Civil Engineering (Jason Yu). That case went on for several years and was ongoing when I left office in late 1987. He did leave a year or so later. I had to adjudicate another plagiarism case – this one between two faculty members in the Materials Science Department, each of whom was my research collaborator

and friend! That was difficult. They stopped talking with each other but did continue talking with me. I guess that was some degree of success.

Our Engineering Advisory Board consisted of 16 individuals, the leaders of Utah's major technical companies. Claire Coleman, President and CEO of Mountain Fuel (later Questar and even later Dominion Energy), and Jules Mirabel, President of Eaton-Kenway Corp., played very important roles in building, developing, and focusing the new Board. The Kenway part of Eaton-Kenway had been founded by former Dean Wayne Brown, who preceded Larry Lattman.

The new Board was influenced by Brown's interests and activities with NSF, technology transfer, and entrepreneurship, beginning with NSF funding in 1976. The University's adjacent Research Park, established in the late 60's, became home to a Utah Innovation Foundation, formed by Wayne Brown in 1984. Brown was also key to NSF's development of the SBIR (Small Business Innovation Research) program in 1982, in the early years of the Reagan administration.

In Fall, 1985 Norman Bangeter was elected Governor, in part on a platform of economic development. The Board and I understood that the new Governor really had no economic development plan, so Jules suggested we formulate and present a Centers of Excellence Program. We did, meeting with the Governor's small staff and advisors. Utah's first Centers of Excellence activities were legislated in the 1985 session, with funds available in the 1985–86 fiscal year. State funding averaged about \$3 million/year, sufficient to fund some 15 Centers each year, including renewals. Dr. Lynn Blake was recruited by the State to manage and operate the program. Two of the first centers funded were the Center for Biopolymers at Interfaces (CBI), in which I was closely involved, and the Center for Controlled Chemical Delivery (CCCD), initiated and headed by sw Kim.

We also formulated and presented an Engineering Initiative to provide funds for salaries, new hires, and for increasing enrollment. It was clear that local firms needed more engineers and had to recruit from out of state to meet their needs. That Engineering Initiative continued for nearly the next two decades.

The Dean's Office worked to coordinate engineering and pre-engineering education throughout the State, including the then two year community

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colleges. I visited every such institution in the state, in several cases using the 'State Plane', which Guil Funston arranged for me via the Governor's Office. It was perhaps reasonable to fly rather than drive to St. George and Cedar City, Utah. But flying to Price and hosting a luncheon at the local country club, pushed and organized by Guil Funston, was perhaps overkill. I probably came across as young, naive, and unrealistic. But I do enjoy flying in small planes!

Deaning was very time consuming. We were trying to do so much to lift, or launch, the College of Engineering to some sort of national stature. Although several of its newer Departments were well recognized (Computer Science, Materials Science), the College as a whole was not. Hosting the ASEE (American Society for Engineering Education) national meeting in June, 1984 helped – it included our sister institutions in the state. I participated in the Engineering Deans Institute and in local talks and meetings to help bring attention to the College and its activities.

Lattman had served as Dean of two colleges: Engineering and Mines. My fellow dean for the College of Mines and Mineral Industries was Milton Wadsworth. Some years earlier, before we were the Deans, we had talked about merging the two colleges – he was somewhat receptive then. But he wasn't at all receptive now. The College of Mines had a lot of old political clout; mining was still a major economic and political force in Utah. His constituency gave him strong orders to just say *No!* to any thoughts of merger. So he did – and I, reluctantly, let it go...

## Kauai

Deaning was very stressful. Our marriage got somewhat strained at this time. So when Barb and I heard about a hiking trip in Kauai, planned by our friend John Warner, we jumped on it. John Warner was Kolff's finance manager and an avid hiker. He would organize hiking trips for the staff and coworkers of the Division of Artificial Organs, me included. It was his trips that introduced Barb and I to many great Utah trails, including Timpanogos. He planned a trip to Kauai, Hawaii to hike and camp the Kalalau trail, a challenging 11 mile coastal

trail along the Na Pali Coast. He arranged everything. David Malm signed up – and so did we.

In May, 1985 we flew to Honolulu, then to Kauai, and by van to the SE end of the road – the Kalalau trailhead. The Na Pali coast is very rugged, steep, scenic. The trail was literally a rut, a goat path, above very steep 200 ft or so cliffs, dropping straight down to the raging surf below. Barb has a fear of heights, especially at cliff edges, and became somewhat spooked. We repacked our packs so we could leave hers behind, hidden in the brush, so she was more able to carefully negotiate the trail. She made it through the really spooky – and dangerous – sections without incident. We watched the goats watch us as we walked.

After a night or two on the trail, we reached the end, a large beautiful beach upon which we could camp for a night or two before returning. Almost immediately upon reaching our destination, John Warner was instantly nude. That was a bit surprising to us, because we knew he was of the Utah ‘local culture’ (i.e. Mormon), which would frown upon such exposure. It didn’t faze him. He was comfortable – as were all others on the beach – and then so were we, at least part of the time. Waterfalls, raging streams, rope bridges for hand holds across the gorges, nude showers, tropical fruit – an absolutely incredible adventure. Then back to Honolulu and home.

## Deaning in Public

Much of my time was used for fund raising and public relations. I worked hard to make the local press and the Legislature aware of the College, its students, its accomplishments, research, and qualities. We developed a rapport with media and the political community, in many instances more effective than what was accomplished by the main Administration.

Engineering Week is a national effort to provide awareness of engineering to the broader public. Held annually, every February, for one week, the events featured lectures, exhibits, and other activities – many of which were to encourage high school students to consider engineering as a career. The local professional engineering societies and the engineering or pre-engineering programs in

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every college in the state were all involved in planning and running Engineering Week.

Engineering Week 1984 or 85 hosted a lecture by William (Bill) Gore, the co-inventor of Teflon, and co-founder of Gore Associates, a major materials and medical supplies company. Bill met his wife Vivian at Westminster College, a local, private four year college in Salt Lake City, when they were undergraduates there. Bill received a MSc. in Chemical Engineering at the UTU. So he was an alum! And someone I wanted to get to know for fund raising purposes.

I introduced Bill Gore at the hotel where he spoke. The sound system and his microphone presence was not good, and Vivian was very concerned that the audience might not hear him. But his soft, sincere voice was very effective in getting their full attention. He got through to nearly everyone, discussing his unique principles of management and engineering.

Gore was quite a hiker and backpacker. He died July, 1986 of a heart attack at the age of 74 while on a backpacking trip in Wyoming's Wind River Range. Although the Gore's have given generously to Westminster College, the UTU never succeeded in its efforts, mine included, to get their support.

## The Potsdam Conference, 1985

In the mid-80s I organized the June, 1985 meeting of the 5th International Conference on Surface and Colloid Science, Clarkson Univ., Potsdam, NY. It was called Protein and Polyelectrolyte Adsorption. I wanted to pull together scientists from diverse areas which I felt would benefit the advancement of protein adsorption science. I'd been a Dean for nearly two years and knew a bit about support and sponsorship. So I raised the money to invite many of them, including some not yet well known to the blood protein and biocompatibility field, including Jacob Klein, Alex Silberberg, and Herbert Jennissen. Leo Vroman and Vlado Hlady also participated. In fact Leo, Vlado, and I shared a bathroom via adjacent rooms in the Clarkson Univ. dormitory where we stayed.



Leo would entertain us by leaving one of his great sketches, caricatures, on the bathroom mirror!

As most of the ‘community’ was not aware of TAMS, I also invited Richard Feldmann to do a highly interactive 3-D presentation of protein structure. That was the most exciting ‘talk’ of the conference. The audience wore polarizing glasses to permit seeing the dual projection overlapped (and polarized) images in 3-D. It was just magical to actually ‘see’ the binding and active sites of enzymes, and the ‘landing strips’ on which diffusing substrate molecules would be oriented and held. Although the images then were static, one could easily imagine how the cracks, crevices, projections, blobs could adjust, move, accommodate, wrap themselves around the ‘bound’ molecule, facilitating chemical interactions and chemical modification. Even current ideas, largely via Jennissen, on multi-binding site cooperativity could be imagined. These ideas and perspectives allowed us all to think far more creatively and dynamically about molecular interactions and processes. The conference proceedings were published a year later in a special issue of the *Journal of Colloid and Interface Science* (June, 1986). Unfortunately, I didn’t include a mention of the Feldmann talk. He didn’t submit a paper, and I didn’t think to draft a brief summary for inclusion.

Vlado and I also attended a plenary lecture by Pierre-Giles De Gennes at that same conference. We were both impressed. Although we expected his talk to be clear and stimulating, it greatly exceeded even our positive expectations. We’d been aware of his pioneering work on polymers and interfaces, including the work of Rondelez and others in his lab. I wanted to get him to UU for a visit and perhaps a short course.

## Our ‘Daughter’, Nina

Elizabeth and Frederick (Klaus) Kopp became dear friends after we first met in the mid-70s, thanks to Kolff. Barb and Elizabeth corresponded. We visited them whenever we were in Europe. They wanted Nina, now of high school age and midway in age between Aaron and Tonio, to spend a year in a Utah high school, mainly to learn American English. Barb and I jumped at the opportunity

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to host Nina for her junior year at the local Cottonwood High School, where Aaron and Tonio were also enrolled. She came, spent 1985–86 with us, and was a delightful guest and surrogate daughter. She provided a civilizing influence on our two boys, each dealing with their own issues and challenges in high school. We would introduce her as our daughter. Chen-ze Hu called her our ‘dry’ daughter, meaning we didn’t have to do any ‘work’ to produce her.

When talking with friends, I would often say Elizabeth is the mother of my daughter, and Frederick the father of my daughter. Then we’d tell the story. Great fun. Nina also played the role well. We all traveled together, interacted with the Eichwalds and Kolffs, and generally had a very pleasant year. We even joked that Nina had two papas and two mamas, but still turned out okay!

## Kolff’s 75th

On Valentine’s Day in 1986 Willem Kolff became 75 years old. Kolff was perhaps the single best known individual connected with the College of Engineering and already a legend in the field of Bioengineering. I wanted to celebrate him. So we organized a 75th Birthday Conference and Festschrift to honor him, Jan. 23–26, 1986 in Salt Lake’s Convention Center, the Salt Palace.

Fortunately the uu’s vp for Research, James Brophy, was very supportive and helped underwrite the costs. We also did a good deal of local and national fund-raising. The meeting involved his collaborators and coworkers from around the world, each agreeing to submit a paper for the Festschrift volume, published by VCH Publishers, in 1987: *Artificial Organs*.

Kolff’s own contribution to the conference and the book was amazing. His talk and paper: ‘The Future of Artificial Organs and of Us All’ was a comprehensive review of the field interspersed with slides and talk/text related to the nation’s spending and actions on armaments and nuclear weapons. This was the era of Reagan, Star-Wars, and the Strategic Defense Initiative. It was a most powerful talk. A copy is posted at [www.joeandrade.org](http://www.joeandrade.org).

Kolff had participated in anti-nuclear testing demonstrations at the Nevada Test Range, north of Las Vegas. He was an activist as well as creative inventor.

I greatly enjoyed organizing and chairing the conference, with the help of RA Normann, DB Olsen, DE Detmer, SW Kim, RL Stephen, and JJ Brophy. And Kolff enjoyed it, too. I did offer to organize a second conference for his 100th birthday, but he didn't make it – he died February 11, 2009 (aged 97), just a few days shy of his Valentine's Day 98th birthday.

## More Deaning

One of our major problems was over enrollment. The College had the unwritten policy of taking all interested students who qualified for University admission. We simply did not have the resources to provide a quality experience for all of them. I somewhat unilaterally, with the reluctant 'approval' of the department chairs, instituted a means to control the numbers of students, via an interim status program. The program was considered controversial. But it worked – and helped provide a stimulus for the University Administration and the Governor to begin to address our budget problem. We also encouraged the development of pre-engineering programs at the other schools in the State System of Higher Education.

We had other serious budget issues, including faculty salaries, which greatly lagged behind our peer schools.

I remember a disgruntled faculty member in Computer Science who had a very good job offer from George Mason University. There was no way I could even begin to match the offer. Knowing he was a very avid outdoorsman, in love with the red canyon country of southern Utah, and knowing that the weekend was approaching, I suggested that he take a few days off, go into southern Utah and just enjoy and think about everything. Then we'd talk again.

There was a general understanding that salaries in the tech areas in Utah were 10 to 20% below those of comparable institutions elsewhere. We used to joke that Utah's incredible mountains and canyon country – our outdoor recreation opportunities – helped 'cover' the 10 to 20% shortfall.

He came back. I had managed to offer a good-faith small adjustment – and he declined the offer from George Mason. I had also told him that I was really

concerned that a strongly libertarian funded institution like GMU would not be a healthy place for any science or engineering program, including computer science. He stayed with us until he retired, continuing to make remarkable contributions in what was already one of the best computer science programs in the nation.

We used the same outdoor life style argument in recruiting graduate students, as many were attracted to Utah specifically because of its mountains, skiing, and red rock canyon country. Their stipends were also lower than competitive schools.

The relatively new Departments of Computer Science, Materials Science, and Bioengineering were doing creative, innovative work, attracting students, and generating research funding, in contrast with the four traditional engineering departments: Chemical, Civil, Electrical, and Mechanical Engineering. I was regularly accosted by the Chair of Computer Science as well as by key productive faculty requesting additional space and resources. I was quite aggressive in reallocating research space, generating strong objection from the faculty who lost space. We did provide additional space for Computer Science, Bioengineering, and for Stephen Jacobsen's program in Mechanical Engineering. To placate Rich Riesenfeld in Computer Science, I asked him to walk the campus with me – we talked and walked. We both then felt better, I think.

I probably met Steve Jacobsen in 1968 when Kolff introduced me to some of his collaborators. Steve was working then on his MSc degree in Mechanical Engineering and had developed a fluidics laboratory, which greatly interested Kolff. They later developed a 'wearable' artificial kidney. Steve finished his ME Masters degree in 1970 and then went on to MIT to do a PhD in artificial arms under Robert Mann, returning to the UU in 1973 as an Assistant Professor of ME and a key Kolff collaborator. Some years earlier Steve had dropped out of his undergrad studies, or been suspended. Then Chair of ME, Wayne Brown, let him back in some time later, impressed by Steve's creativity and new commitment. He went on to have a remarkable, creative, productive career until his death in 2016.

Stephen and I would often pass in the halls of the cavernous Merrill Engineering Building. He would give me an ambiguous smile, saying 'Are we having fun yet?'

## Engineering Ethics – 1986 and 2021

We also considered public and societal needs and responsibilities. One particular event was the 1986 launch of NASA's Challenger Space Shuttle on a very cold January day. The Shuttle exploded, killing all on board. The tragedy led to enormous media exposure, studies, hearings, interviews. It became a study of the ethics and responsibilities of engineers. Allan J McDonald, a Morton-Thiokol engineer who led the rocket booster team, had cautioned against launching on a freezing cold day, due to O-ring sealing and leak issues. He was overruled – not by engineering but by management. McDonald's obit appeared today (3-10-2021), prompting this paragraph. In 2009 he wrote a book on the disaster and on its aftermath.

There was an investigation of the disaster and of the Shuttle Program. There were hearings, editorials, finger-pointing, speeches, op-eds, and books. Richard Feynman, Nobelist and 'very curious character' (one of his book sub-titles) was asked to serve on the Congressional Commission. He almost said 'No, thanks.' His wife, Gweneth, dissuaded him: 'There isn't anyone else who can do that like you can.'

Another reason that same cold January day sticks in my head, is that's the day Barb had a hysterectomy at the local Holy Cross Hospital, near the UU. It was a challenging time for her – and me.

## Deaning – Budgets

The serious budget issues persisted. Gov. Norman H. Bangerter ordered a 6% cut in the budget for Higher Education in the state for the 1987–88 school year. President Chase N. Peterson announced that the University of Utah would lose nearly \$10 million. Entire programs, as well as select faculty and staff, would be dropped.

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The Administration had not been supportive of Engineering's direct interactions with the Governor and the new State Office of Economic Development, nor in our largely unilateral limits on enrollment and class sizes. I warned that unless there was a real improvement in funding for the College of Engineering, faculty would begin to vote with their feet. Our Advisory Board and Industrial Affiliates worked hard on the Governor and the Legislature to support a tax increase and a dead-wood pruning strategy for budget reallocation. All such actions were communicated clearly and regularly to the College and local engineering community, including the press. We initiated an Engineering newsletter, which was widely distributed. Again, unpopular with the Administration.

Final action by the Legislature was completed by the end of February 1987. The state-supported schools were to make cuts as ordered by the Governor. If there was to be some tax increase, those additional funds were to be used to bolster faculty salaries and build up the remaining units in the system, not to restore cut or pruned programs. Such an approach was not popular with the Administration.

I proposed to cut the Civil Engineering Department and the Industrial Engineering program in Mechanical Engineering, as well as cut salaries and budgets in the traditional engineering programs, while leaving the newer, more productive departments and programs unbothered and in some instances enhanced. Not generally popular.

When it was clear that the overall budget situation would not be very bad, due to a state tax increase, I insisted on knowing what the University planned for my overall budget. They refused to commit. They kept delaying long after I felt was prudent.

## Resigning...

I became annoyed, even angry, with the Administration's inability – even disinterest – to paint probable scenarios. To be able to say 'If this is the case, *then* we'll do this.' Engineers do this all the time. Solutions to problems are defined

in large part by constraints – by ‘boundary conditions’. But Peterson (an MD) and VP Altman (a psychology PhD) just couldn’t deal with realistic scenarios.

I decided to prepare to resign – in protest. I talked with David Pershing, a very successful and creative young associate professor of chemical engineering. Dave was serving as Associate Dean of the Graduate School. We had talked about academic leadership and engineering education. We discussed my resignation. We both knew that Dave would likely be asked to serve if I resigned – or if I was fired. I was confident he would be an excellent replacement for me. I had played all my ‘cards’ with the current administration. They were very annoyed with my direct access to the Governor’s Office and the press. I understood that my effectiveness was becoming quite limited. I kept the faculty, staff, alumni, and local community – including the press – apprised of my concerns and then of my ‘protest’ resignation.

I suggested to Dave that he should be tough in his response to the Administration’s inquiry as to his interests in being named Dean of Engineering. As it played out, his offer included most of the demands that I had made – and been denied – just prior to my resignation. Although I submitted my resignation in late June, I made it effective October 1, well into the 87–88 fiscal year, so I would have full control over the College budget for 1987–88. I was able to submit and implement that year’s budget before leaving office. Although I had trust and faith in Dave, there was no guarantee that he would be Dean. And I had no such trust in the higher Administration.

My resignation was promptly accepted. I did let the local press know; each of the two major papers published a story, helping put, perhaps, a bit of ‘pressure’ on the indecisive Administration to address the issues I’d raised. On October 1, 1987 I left the office, moved into a 4th floor secluded office to stay under the radar, and took a year of sabbatical leave.

I then applied for several University Presidency positions. Peter Gerity helped by writing and submitting ‘nomination’ letters for me. It’s all at [www.joeandrade.org](http://www.joeandrade.org). I had been studying the issue of academic leadership, concluding that most university presidents were placed well above the Peter Principle threshold – most had difficulty making hard decisions, most lacked any vision, most expected to manage a stable, well funded, quiet institution. I wanted to do just the opposite. I read the memoirs of many recent university presidents, acquired a library on Leadership, including Walter Bennis: *Why Leaders Can’t*

*Lead – The Unconscious Conspiracy Continues*, 1989. There was no interest in my applications. So, after several years, I lost interest in being a university president and went on to other activities.

David W. Pershing was appointed Dean of the College of Engineering, effective October 1, 1987. It all worked out. The College got its resources. Civil and Industrial Engineering's local political clout enabled Dave to negotiate for additional funds to 'save' the programs. Peter Gerity stayed on to work with Dave on the Engineering Initiative and on many other issues and programs. Peter then moved on to become Research VP at USU in 1995. Dave moved up to UTU senior vice president for Academic Affairs in 1998. In March 2012, Pershing was named president of the University of Utah, serving until 2018. Pete Gerity went on to New Mexico Tech, where Larry Lattman was serving as President. A win-win for all.

## Research while Deaning

Research and technical work were ongoing. Our work on fiber optic-based sensors started in about 1985. We addressed, thanks to discussions with Ira Skurnik of DARPA, the question of sensors or dosimeters? That got us into the the science of binding constants, on- and off-rates for antigen-antibody (Ag-Ab) interactions, thanks to much collaboration with Jim Herron. Art Janata first introduced me to the chocolate-loving Skurnik, who was my first contact into the DARPA establishment.

During my years as Dean I continued research but did very little teaching. I did teach Surface Science from the then relatively new book by Israelachvili, *Intermolecular and Surface Forces*, 1985. This helped set the stage for our new work with Atomic Force Microscopy (AFM).

The new Center for Biopolymers at Interfaces (CBI) was up and running. I had 'recruited' Karin Caldwell from the Chemistry Department in 1985 to set up and manage CBI. Karin's experience with proteins and polymers at interfaces was perfect for CBI's vision and challenges. She served as Director from its formal inception in 1986 until her resignation in 1997. At its peak CBI counted



25 member industries, and 24 faculty members from different departments and colleges across the UU campus. She was also interested and active in technology transfer and how to foster constructive relations between academic and industrial research groups.

CBI provided seed funding to permit faculty to explore new ideas and directions. Most of my new projects were initiated via CBI support, including STM and AFM studies. Li Feng and CZ Hu continued their STM work well into the 90's, soon to be joined by Jinn-Nan Lin and others working with AFM – based on the pioneering work of and collaboration with Prof. Paul Hansma at UC Santa Barbara.

The Center for Controlled Chemical Delivery (CCCD) was founded by Sung Wan Kim in 1986 and funded via the Centers of Excellence, the same time as CBI. Both Kim and Kopecek, and many others, were inspired by Helmut Ringsdorf's suggestion that water soluble polymers could be modified to serve as carriers of drugs, allowing drug activity to be transported throughout the blood system. By equipping the polymers with site-specific molecules, such as antibodies, or the Fab domains of antibodies, these molecular complexes would 'target' drug activity to specific sites. Targetable drug delivery was an exciting concept. And the polymers that Henry and Pavla were studying would serve as near ideal carriers. CCCD could provide funding for people and starter grants for research ideas. It was an ideal vehicle with which to initiate partnerships.

In the mid-80s I completed the two volume book, *Surface and Interfacial Aspects of Biomedical Polymers*, with many of the chapters written by our group and close collaborators.

A close collaboration with Jim Herron in the Biology Department introduced us to novel anti-fluorescein antibodies which permitted a variety of novel experiments on antibodies at interfaces, and provided the foundation for our new efforts on protein-based biosensors. The antibody expertise also merged beautifully with the CCCD goal of targeted drug carriers. Jim later joined the Pharmaceutics faculty, joining Kim and Kopecek.

The mid-80's also brought our work on polyethylene oxide – based protein-resistant surfaces, allowing a simple surface treatment to provide some enhanced initial biocompatibility. This was based in part on some pioneering work by Edward Merrill at MIT on 'Polyethylene oxide (PEO) as a Biomaterial', a title reminiscent of my own 'Water as a Biomaterial' paper. Merrill was also

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the guy I met and talked with the day after my Los Angeles airport vasectomy! Small PEO molecules would serve as ideal tethers for drugs and for the site-specific agents used for targetable drug carriers. It all came together nicely.

Our work on TIRF, waveguides, and fiber optics expanded. Carl Newby's MSC thesis started our efforts on fiber optic-based immunosensors; Dan Reinecke's MSC helped develop the basis for signal calibration. Work on protein adsorption continued (Hansen, Rickel), on gel swelling and characterization, on surface dynamics (Park, Lawry), and on pyrolyzed polyimide and on to bio-medical carbons (Hu, Feng).

## Consulting and Travels

In the mid-80s I served on the U Washington NESAC advisory board, a National ESCA and Surface Analysis Center. With the award of NESAC Buddy Ratner obtained his own ESCA instrument and greatly expanded his work. The major customer of our Surface Analysis Lab was gone! Service on Buddy's Board was very interesting and helpful. I also consulted with Ciba Vision on tears, proteins, and contact lenses.

A San Diego Optical Fibers Conference, consulting with IO Labs, and a CCCD-organized Drug Delivery conference in SLC started out 1985. There were several DC-Bethesda funding-related meetings in March. DARPA's Ira Skurnik visited UU in March; my thanks to Art Janata for introducing me to him. In April I was part of a 'Keystone Conference' in Colorado. Nobelist Kai Siegbahn (for work on ESCA) from Sweden gave the Frontiers of Science lecture in April; Chuck Bryson from HP in Palo Alto flew in for the event – and to check out our HP-ESCA installation. There was also an ASAIO meeting that May. I returned to Capri, Italy in May for a meeting on Polymers in Medicine, recalling the great time Barb and I had there some 12 years earlier. Next was a Holderness Academy Biomaterials conference. The Colloid Society symposium at Clarkson, in Potsdam, NY was next. In the fall I met and visited with alum Si Ramo of TRW at the LA Country Club. This was a dean fund-raising

gig. He was interested and sympathetic, but no donation. There were many such fund-raising trips over those 4 years as dean – nearly all unsuccessful.

The Biomaterials Society partnered with Clemson University, starting in the early 80s, to select and present the Clemson Awards in Biomaterials. Started and promoted by Clemson's creative and outgoing Sam Hulbert (an expert on biomedical applications of ceramics), these awards were in three sub-areas of Biomaterials Science and Engineering (BMSE):

Basic Research – PN Sawyer

Applied Research – ws Pierce

Contributions to the Literature – JD Andrade.

It was quite an honor. I had developed a reputation (thanks to Current Contents) for being aware of almost everything going on in BMSE.

Late 1985 travel included a major ESCA conference, ECASIA-85, probably in Paris. I continued on to Basel, perhaps related to Molecular Graphics. Helmut Ringsdorf arranged intros and visits with Hoechst and BASF, probably on our early sensor work.

November was the memorable Yugoslav Air flight with Vlado; he was returning home from his two years in Utah. Yugoslav Air had only a very few flights – it was the cheapest way to get to Zagreb at the time. The gate they used was at the far end of a long terminal corridor. We were still a ¼ mile or so away when I saw smoke. I was concerned, thinking the gate or the plane might be on fire. Vlado knew I didn't like smoke or smoking. He smiled.

"It's just Yugo Air," he said. "They all smoke."

And that's all it was.

From Zagreb I went to Milan and then to Torino via a black Mercedes high speed driver working for Sorin Biomedica. A hotel in Torino, then by the same high speed car to the site in Saluggia to work with Ennio Denti. Another consultant advisor, Pierre Galletti, was also there. I think he served on Sorin's Board. Galletti was very well known in artificial organs, especially oxygenators. He was a contemporary of Kolff. He became a friend and colleague; we worked together in the early 90s to set up AIMBE, the American Institute for Medical and Biological Engineering.

Washington, DC-Bethesda beckoned in December, and a visit with Skurnik at DARPA and talks/discussions with ICI, Dupont, and (maybe) Hercules – all on polymers and their surfaces.

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Summer, 1986 found me back in Torino, with Barb and the boys, surviving another high speed Mercedes ride. The kids loved it. Then it was on to Zagreb for the Ruder Boskovic conference at Red Island, a beautiful place. Vlado and I presented papers, published a year later in *Croatica Chimica Acta*, dealing with protein denaturation upon adsorption. I met many of Vlado's colleagues and coworkers. Our family then went to Plitvice Lakes National Park, south of Zagreb – a beautiful, almost magical place – many lakes, connecting streams, waterfalls, and carbonate formations. We also saw a few glow-worms on the resort grounds at night.

Later that year I was in Copenhagen, Lund, Linkoping and Stockholm talking with Matiasson, Lundstrom, Elwing and Pharmacia. In November I participated in a NYAS conference organized by Ed Leonard and Leo Vroman. That was our first paper on The Big Twelve – the major proteins in plasma.

Then it was off to Japan – to Tokyo to see Sakurai, Toray in Kyoto, and a Mt Fuji resort to present at a biosensors meeting organized by Aizawa and to talk with Akaike. I then routed to Seoul for discussions with Hai Bang Lee.

The Phoenix Biomaterials Society meeting was in December – and a short visit with the Olsens.

My brother Bob, on seeing my passport one Christmas visit, indicated he was sure I simply worked for the CIA or the State Department!

## Recreation and Friends

My mother, Erma, helped organize a Maciel extended family reunion on May 11, 1985 at a lake near Merced. Barb and I participated for the afternoon with all the relatives. Erma, her Mom, Maryanna, and all her siblings were present.

August, 1985 was The Tetons with Hladys, having forgotten our sleeping bags. It was a cold night. This was just months before their return to Zagreb.

Sept. 1985 Barb and I did the Pfeifferhorn, above Red Pine Lake in Little Cottonwood Canyon. Jinn-Nan and his wife, Suzanne and Bob Ramsey, Vlado and Milena, Paul Dryden, Monty Reichert, and others. That was the hike that led Jinn-Nan to say something like:

‘Yes, a one day hike – but you feel it for weeks after!’

Old high school buddy Igor Skaredoff and his family visited us in September. Erma came in the fall, and went with Milena to services at St Ambrose church. Tonio graduated from Cottonwood High in 1986.

## **Part III: The Late 80s – After Deaning**

### **Travels, Visitors, Schools**

Thanks to Art Janata, I was invited to lecture in Saas-Fe in the Swiss Alps in March, 1987. I then rode the incredible Glacier Express to Zurich, visited IBM-Zurich to see their AFM group, and went on via Milan to see Hladys in Zagreb. Nikola Hlady was born in Zagreb on Christmas Day, 1986. Nearly new Nikola was 3 or so months old when I watched him being bathed in their kitchen sink. It may have been on this trip that Vlado and I hiked up Mt. Sljeme in Zagreb, coming up with ideas and inventions for sensors and sensing on the way up and down, stopping every so often to make notes and sketches in my ever-present pocket notepad. Vlado told me decades later that the mountain is called *Medvednica* and its top is called *Sljeme* (literally: mountain ridge). Local jargon is: *idemo na Sljeme* (let’s go to the top of the Medvednica). We enjoyed walking, thinking, inventing.

In March Barb and I participated in Lee Smith’s Heber ranch winter outing. This was an artificial organs group nearly annual event. We would meet at Smith’s cabin, near Strawberry Reservoir, for a weekend of cross-country skiing and good comaraderie. The events were usually scheduled on a weekend near a full moon in March. The evening moonlight skiing was a delight.

Jeff Ives was serving as an unofficial outdoor social event organizer. He organized a rafting trip on the Green River, ending just within Dinosaur National

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Monument. Aaron and Tonio accompanied me. It was a largely easy, lazy trip, although Paul Dryden got caught underwater for a scary time. Kopeceks were with us.

In early July Barb and I traveled to Europe. We were with the Kopps in Ebersburg for Frederick's birthday, July 4. Barb went on to Zagreb for 10 days, where she met the now seven month old Nikola. I returned to Boston for the Gordon Conf. on Biomaterials – and gave an important talk on the domain and dynamic nature of proteins, demonstrating my demo fictional interactive (via overhead transparencies) proteins: Domainin, Anisotropin, and Cooperatin. We 'played' with fibrinogen, albumin, and immunoglobulins, as well as simpler model proteins.

Leo Vroman produced delightful caricatures of all the conference presenters, and presented them at the evening banquet. At the conference I met and interacted with L Graham, a vascular surgeon. We hiked with Ratner and others. The bus back to Boston airport included discussions with a Parisian Complement researcher as well as Graham.

In August we hiked Timpanogos and later, via Jeff Ives, Deseret Peak, in the nearby Deseret Peak Wilderness, just west of Grantsville. I'd been doing a lot of hiking and apparently had strained my ankles somewhat. While playing badminton on our back lawn with Pavla, my ankle collapsed, and down I went – a very bad sprain, requiring an elastic bandage brace.

I was due to participate in a major chromatography meeting, via Jennissen, in Oberammergau, a historic and very special German village. But first I had to get a proposal finished and submitted through the UU process. I finished it, got the signatures, and delivered it to the Admin Building. I was literally hopping on my one good ankle up the stairs of the Park Building... and crack – out went the second ankle! I dragged myself back to my office and on home. I had just days to get ready for the Germany trip, but couldn't carry luggage, requiring two canes to painfully walk. We quickly purchased a large backpack to which a carry on backpack was connected. That allowed me to travel with everything on my back. I could check the large pack, carry the smaller one, and hobble all of that with my two cane transport system. It worked.

I routed to Detroit to see L Graham at U Michigan, Ann Arbor, as she was finishing a proposal which included our research collaboration, then flew on to Germany. The conference and talk went well. I routed back to Detroit, saw

Graham again and rode with her to Toledo, then flew home from there. She was going on to Case Western for a new position.

After returning home Barb, the kids, and I then drove to Mill Valley. I flew from SFO to LA for an STM meeting in Oxnard, then back to SFO and Mill Valley, and we drove home.

I gave lectures and did some consulting for 3M, Medtronic, Allergan, Eli Lilly. We hosted visitors from Prague (Kalal, Dusek), Mainz (Ringsdorf), Belgium (Lukosz), Sweden (Nylander, Arnebrant).

When Karel Dusek was visiting, we had breakfast near the UU. I had Aaron with me, as it was the first day of school; I had to deliver him to his Open Classroom school. We were running a bit late, so I was moving rather speedily down 20th East; Dusek was in the back seat, as we were going to continue our discussions at the UU after dropping Aaron off. I got pulled over by a waiting policeman. He lectured us about first day of school risk and accidents. He let us go. Dusek was enthralled, inquisitive, very interested. He was curious as to policing and authority in the USA. He was used to the Eastern European authorities – this was just before The Wall came down.

Sally Smith, the wife of Lee Smith, began her remarkable A Woman's Place bookstore in 1987, providing books by and for women. Located in Lamplighter Square, adjacent to a state liquor store, it attracted women writers, feminists, and many readers and supporters. It closed in 1998, after having expanded to four stores in the area.

The Smiths live on Sunnyside Ave, below the Zoo and just down the hill from the home where Pim and Yanke Kolff lived. Sally became a friend and confidante of Yanke. The Kolff's retirement celebration in 1997 was held in their spacious yard.

We held an Ex-Dean!! Party in October, 1987, celebrating the end of my four plus years as Dean. We made plans for my well-earned sabbatical leave. I had moved, with Paul Dryden's great help, to the 4th floor of MEB, into a long narrow office with room for my many file cabinets, although we had to store some of them in one of our labs. Paul had equipped the office with many, many book shelves.

I think it was November, perhaps around Thanksgiving break, when Aaron and I did his college shopping trip. We visited the U of Puget Sound and Evergreen State in Washington. Jill Williams had attended and graduated

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from Evergreen and recommended it to us. We then routed down to Portland to visit Lewis and Clark College, and then to Willamette U in Salem, ending the search in Eugene at U of Oregon (we didn't get to OSU in Corvallis). While on the UO campus, we ran into a campus tour group; Aaron joined the group, and liked what he saw. We did some additional looking and inquiring on campus – and that was it. Aaron's perception was that it seemed like a mini-Berkeley, an appealing balance of liberal/radical and safe. Either then, or a short time later, Aaron decided on U of O.

December, 1987 involved more technical travel. JN Lin and I attended a so-called UCLA Symposium on Protein Recognition in Santa Fe, where we met, I think, Ephraim Katchalski, whose earlier work on enzyme immobilization helped inspire and facilitate our own work on immobilized albumin and antibodies. Later I participated in an annual contractors meeting at NIH, and talked at the National Bureau of Standards. Then it was on to Minneapolis to visit with Medtronic and the U of Minnesota for a talk and an informal interview for their Chair of Bioengineering position. I had earlier declined interest but they insisted on a talk and tour. And that wrapped up a busy 1987.

Vlado, Milena, and baby Nik visited in late 1987 and stayed with us, on the floor in our little 'middle room' between the boys' bedrooms. Nikola needed regular warm milk and baby food, so Vlado went out and purchased a microwave for us! We didn't have one, being a bit tech-reticent at the time.

Deaning had been very time consuming. Leaving that job meant far more time for teaching, research, travel, and family. In mid-1987 I began considering invitations to visit and work in interesting places. Two were especially alluring: Paris and China/Beijing.

In early 1988 I visited the IBM AFM group near Mt. Kisco, NY, then went on to Paris to begin a visiting professor appointment with Marcel Jozefowicz and his group at the U of Paris XIII.



## Tonio, Reed, and Graduation

Tonio graduated from Cottonwood High in mid-1983 and went on to Reed College in Portland in 1984. He had also considered St. Johns in Santa Fe. His close friend Jamie Lee had visited Reed, returned with a glowing recommendation, and they both decided on Reed.

We would travel to and from Portland regularly to see Tonio – and Barb’s two sisters, Jill and Antonia. Two years later Aaron graduated from high school, and then enrolled at U of Oregon, so we had many reasons to take trips to Oregon.

## France, Jozefowicz, and deGennes

In the early 80s I began trying to interest Pierre de Gennes in visiting and lecturing at the U of Utah. I had learned of his remarkable book *Scaling Concepts in Polymer Physics*, 1979, and read of his work on polymers as blobs, nets, and ‘snakes’ – his concept of ‘reptation’ – all most relevant to our work on polymers at interfaces. De Gennes was already very well known for his work on superconductivity and liquid crystals. After Vlado Hlady and I heard him speak in Potsdam in 1985, we really wanted to meet him and get his perspective on our own work. I heard him again at an IUPAC conference in Mainz, West Germany in 1986, before the ‘Wall’ came down. His approach to complex physics ‘problems’ was remarkably simplistic. It reminded me of the old joke about a theoretical physicist working on a dairy farm. He begins his lecture:

‘First assume a spherical cow...’

It worked – for de Gennes.

He had an all encompassing view of physics and the insight to be able to apply ideas and theories from one area to a very different, assumed to be separate, area of physics, with remarkable results.

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From his *Nature* obit, by his collaborator and mother of 4 of his 7 children, Francoise Brochard-Wyart:

“Every one of us has a treasure of images caught in glimpses but never forgotten.... With his strikingly simple yet pioneering ideas, Pierre-Gilles de Gennes drew ‘white lines in large strokes’ that defined the physics of soft matter ...

He pursued his research with extraordinary imagination, insatiable curiosity and an ability to grasp facts rapidly. But he also gave his time to others and helped them develop their ideas.

A keen ambassador of science to the public...”

He was simply brilliant.

Marcel Jozefowicz – charismatic, energetic polymer scientist – has worked in biomaterials for most of his career, working closely with his chemist-scientist wife, Jacqueline. They ran a French CNRS lab in U of Paris 13 Nord, just north of St. Denis. Marcel had managed to secure a source of funds to permit him to invite visiting faculty for short periods. After meeting the Jozefowiczs at conferences, and hosting them at our home in Salt Lake in mid-1985, we continued meeting and corresponding.

In early February 1988 I was a visiting prof in the Jozefowicz labs, giving several lectures, meeting with students and staff, and visiting other French labs and researchers in the area.

The Jozefowicz groups were working on synthetic polymers which mimicked some of the characteristics of the polysaccharide heparin, a well known and well used anticoagulant. Marcel was interested in the binding characteristics of his polymers and of heparin. This led to several discussions on binding specificity, binding energies, and binding constants. These were topics of interest to me and our group’s work on antibody-antigen binding and specificity.

Biochemistry seems to function on ‘specificity’ while most synthetic polymer interactions are often thought of in terms of much lower strength non-specific binding. After some deliberation I included these considerations in one of two papers I gave some years later at a workshop in Turkey in 1992. I suggested that synthetic polymers could exhibit a ‘statistical specificity’, based on the number and distribution of their organic functional groups. This could allow Marcel’s sulfonated polystyrenes to exhibit ‘heparin-like’ binding properties. These ideas also involve binding ‘constants’, binding kinetics, and multi-site cooperativity. I

dubbed the statistical specificity concept the ‘Marcel and Jacqueline Effect’. Marcel liked that!

Pierre de Gennes’ lab was in central Paris at the Collège de France. As part of my duties and personal goals in working with the Jozefowicz was to become more aware of French scientists, I asked Marcel to arrange a meeting with de Gennes. They were both heads of French national labs. Although a bit hesitant at first (Marcel was rarely hesitant about anything), we did get an appointment to see de Gennes in his lab and office. We were escorted in, met the very tall, lanky, dynamic Pierre-Giles de Gennes, and started a discussion. His ‘office’-meeting area had a very large solid wall covered with a floor to ceiling blackboard, filled with sketches, notes, equations – the scribbles of productive physicists. It was incredible. We talked and talked.

We found our common interests included not only polymers, wetting, and adsorption but also social issues: education, motivation, ignorance, environment, population. I probably talked with him about The Leonardo. Marcel and I then visited the de Gennes group labs.

We also visited Francois Rondelez and his group. Our common interests stemmed back many years due to his pioneering work with de Gennes on the behavior of polymer molecules at interfaces. Rondelez, with his family, had visited us in Salt Lake City in summer of 1982. The entire family slept on our family room floor, on foam pads. We had a large rusty 50 gallon barrel in the backyard. The boys placed it on the back lawn and rolled it by standing on top and ‘walking’. Aaron, Tonio, and the Rondolez kids all walked the barrel. Great fun for all.

Peter Suci, a student of Monty Reichert’s working on Variable Angle TIRF (to distance-profile interfacial concentration) finished his UU PhD in 1988 and went on to a postdoc at the Collège de France with Rondelez and his collaborators.

## On Nobelists

I became intrigued by Nobelists. They were smart, creative, responsible, articulate, effective. Perhaps some, like Siegbahn, could be boring. Many, like Paul Flory, were involved with human rights.

A very different, also brilliant, theoretical physicist came to my attention at about this time. In Feb. 1988 Richard Feynman died. I 'knew' of him via his *Lectures on Physics* volumes and his more popular books *Surely You're Joking Mr. Feynman* and *What do you Care what other People Think?* His service on the Challenger space shuttle commission was a great and brilliant public service. His wife, Gweneth, convinced him to serve (he was already suffering from terminal cancer). She said to him:

"If you don't do it, there will be 12 people, all in a group, going around from place to place together. But if you join the commission, there will be 11 people – all in a group, going around from place to place together – while the 12th one runs around all over the place, checking all kinds of unusual things. There probably won't be anything, but if there is, you'll find it. There isn't anyone else who can do that like you can."

His Challenger O-ring in ice water demonstration in front of live TV demonstrated to the world that managers or administrators must not have final say on risky science or technical questions – or decisions. He was indeed the one member who brought Commission and media attention to the O-ring situation and to the management coverup which NASA was attempting to orchestrate.

Many years later, in 2010, President Barack Obama would ask his Secretary of Energy, physics Nobelist Steve Chu, to tackle the BP Deepwater Horizon oil spill disaster; he did, technically and administratively, and very effectively. Obama would later say 'surround yourself with brains, minimize mediocrity.'

And then we got Trump.

## More on de Gennes

I reminded deGennes of the invite to Utah and promised an honorarium that would make the trip comfortable for him. He did volunteer that he and Francoise Brochard-Wyart had been thinking of a summer vacation in Ireland, but ... they'd always wanted to see the American West. So I suggested they go to Ireland a later year, and come to Utah *this* summer.

When I returned to Salt Lake Karin Caldwell and I went all out to find the funds and prepare an invitation that would encourage them to say *Oui*. He did and they came. In early June we announced The De Gennes-Brochard Lectures on Polymers and Interfaces, July 18–22, 1988.

A lot was happening that summer, for me and for de Gennes. He said, as they would be bringing 'the children', they'd take care of their own arrangements. Cool.

So as the course drew nearer, we didn't know where they'd stay in Salt Lake nor when they'd actually arrive. We had signed up students, generated public interest, and even some media interest in the visit. I tried somewhat desperately to make contact. Finally, a few days before the course he did make contact: they had booked a family suite right on 4th South Street, very close to the uu. They were fine, they'd be ready for the course Monday morning. I don't recall what they did with the kids. I do recall meeting them all, I think, at breakfast that first morning. They were all heavily sun tanned and looked like 'desert rats'. They had been walking and hiking through southern Utah for a week or so!

The lectures began as scheduled each morning for 2 ½ hours, followed by a working luncheon in the Panorama Room restaurant on campus. Those attending the lectures for credit were treated to a final exam which I largely wrote and 'graded', with de Gennes' input and oversight. It was a very successful short course – really an event.

The de Gennes had the afternoons and evenings largely free. We went to our local 10,000 ft elevation Cecret Lake, above beautiful Albion Basin in Little Cottonwood Canyon. We drove in to the basin, and hiked the one mile to the lake. The party included Pierre, Madam Brochard, their accompanying children, Henk Busscher (visiting from The Netherlands) and his family, Barb and me. We filled our small red-orange rubber raft with air, and gently launched it on

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the lake. The kids – two at a time – went floating on the lake (with life preservers) and gently paddled around. A beautiful summer day. All had a great time.

S I Jeon had just arrived from Kangreung, South Korea, to work with our group for a year as a Visiting Asst. Professor. He arrived just days before the de Gennes-Brochard lectures. He was tasked with developing a theory for protein interactions with surfaces coated with polyethylene oxide (PEO) chains, based on de Gennes' scaling ideas and interfacial theories. De Gennes and I discussed such work, alongside his gigantic blackboard, when we visited in his lab in Feb. 1988.

Jeon had been fully briefed on the project and my expectations long before he arrived, especially once we knew de Gennes would indeed be in Salt Lake City. Jeon worked feverishly to put together a theoretical approach, which we discussed with de Gennes early in the first several days of his lectures. Jeon would attend the lecture, then work very hard all afternoon and evening, and repeat day after day for the week. He had a fairly complete draft in place before de Gennes left. At our last luncheon together with de Gennes, we went over the paper. He knew we wanted him to be the senior coauthor. At the end of the discussion, I asked him

“May we proceed with finalizing and submitting this important paper?”

He answered, quietly:

“Yes, it represents my perspectives and understandings.”

The next day he and family bid us adieu and left for Los Angeles.

Jeon and I finished the paper, submitted it, revised it, and it was published in 1991. We were very pleased. I was especially pleased some years later when George Whitesides of Harvard put the paper to a careful experimental test, verifying its validity and applicability. We were all pleased, again.

## De Gennes and the Nobel Prize

De Gennes was rumored to be a leading candidate for the Nobel in Physics in 1991. Karin Caldwell and I, together with many other faculty, had urged the UTU to present him with an honorary degree in 1989 or 1990, based on his Utah lectures and our joint paper. Honorary degree decisions are made by the President of the University, then Chase Peterson (1983–91). I had had a bit of a row with President Peterson in 1987 when I criticized him for being indecisive, and then resigned as Dean in protest of his inactions. Oz Rothermich, his Man Friday, was our immediate go between. Karin Caldwell, Director of CBI, and I tried to persuade the President to consider de Gennes for an honorary degree. I recall a ‘discussion’ with Oz and Karin in her office regarding inaction on the honorary degree request. The discussion got quite heated. Oz, a former Jesuit priest, used a string of swear words – in Karin’s presence! Karin could hold her own among arrogant, insensitive men, and responded a bit in kind, as did I. The Administration declined the consideration for an honorary degree!

When de Gennes was named as the Nobel winner in Physics in 1991 we again tried to generate interest in an honorary degree. Peterson retired that same year. Art Smith became President in 1991. We again asked the Office of the President to consider granting an honorary degree at the June 1995 commencement. It was signed by Karin and me, and by the Deans and Chairs of nearly all science colleges and departments. Nothing.

When Barb and I were in Paris in summer of 1998, we had lunch with Pierre and with Françoise Brochard at a tiny café near the Collège. We were so pleased that they made some time for us, as Pierre was scheduled to leave Paris the next day. We reminisced about their visit to Utah, the raft, the kids, and Cecret Lake. The discussion was punctuated by the falling of Barb’s wine glass – a clear demonstration of both gravity and fragility! Barb turned a bright Cabernet color; the waiter quickly restored normality. We also discussed our common interests in the teaching and education of science and critical thinking in the public schools.

With his Nobel Prize publicity, De Gennes had taken to the road throughout France and its regions, talking with high school students. I was working hard on *The Leonardo* and *Science without Walls*, with similar objectives. Pierre had written a book, with Jacques Badot, *Fragile Objects: Soft Matter, Hard Science, and the Thrill of Discovery*, 1996. It was a summary of his year on the road. It is also a sort of memoir of his education and societal interests and thoughts. We parted the café with warm hugs and goodbyes.

He died in May, 2007, at the age of 74. I arranged for a small piece in the *Salt Lake Tribune* noting his 1988 lectures and love for Utah. He was a truly brilliant and remarkable man. I fondly recall his tall bearing and friendly, beaming smile – and his liberal use of *d'accord* – meaning I agree, or OK.

## Travels, Tonio, Bordeaux, the Pyrenees

Tonio graduated from Reed in mid-1988, then studied Chinese at UC-Berkeley that summer. He spent the 1988–89 academic year at home in Salt Lake, taking 111 courses and working in its Marriott Library. He also worked for Kolff during that time. Some months later he studied French at the Sorbonne in Paris, then on to U Illinois to study history and work with Prof. Geoffrey Parker. Parker then accepted a position at Yale; Tonio later went on to do his PhD at Yale, graduating in 2000. Newly inaugurated little George Bush gave the commencement talk that year, noting that a C minus Yale record is sufficient to be President!

Mid-1988 was more travel and talks. In March I spoke at a Cal Tech workshop and visited Allergan in Irvine. Later I was at U of Missouri in Rolla for a talk and then on to a contact lens meeting in St. Louis. I then went on to Milan to visit Sorin again in Torino, then a quick trip to Zagreb to work with Vlado. In April, perhaps on the way back from Europe, I went to SUNY – Buffalo to see Bob Baier, Carel Van Oss, and Robert Good. And later that month to



UC-Berkeley for an informal interview related to their Chairperson search for the new Bioengineering program.

The Baier visit was especially interesting. We discussed surface energetics, contact angle dynamics, etc. I recall being in his office. On his desk was a literally 4 to 5 ft high pile of papers, nearly vertical. I asked him how he found what he might want in it. He assured me there was an order – a structure – and proceeded to pull one of my papers from the stack! It made my desk mess at UU look absolutely clean and organized.

During the month with Jozefowicz I had traveled to southern France to meet Charles Baquey and coworkers in Bordeaux, the major gateway to the magnificent Pyrenees. Later I received an invitation to participate in conferences in Bordeaux, via an invite by Baquey for an INSERM (a French bioscience research agency) conference on Hybrid Artificial Organs. I was also invited by Sorin Biomedica, the Torino firm where Ennio Denti worked, to give a talk at the European Cardiothoracic meeting at about the same time – on our collaborative pyrolytic carbon work. The invite was for me and Barb (it was a conference focused on surgeons, so invites generally covered two people). Barb was teaching and couldn't make it, so Tonio was my companion.

We flew to Paris in Sept. 1988, rented a car, drove to Bordeaux, and to the Parc Nacional du Pyrenees, where we hiked for several days. The highlight for me was the Breche du Roland, a cut in the ridge separating France from Spain. We stayed at a mountain lodge at the base of the snow field, hiked up to the ridge, and peered into Spain. Magnificent! I purchased a remarkable picture poster of the Breche and the ridge in a small shop at the hotel. After returning to Salt Lake, I had it mounted on foam board; it's been hanging in my basement 'office' ever since – a reminder of a wonderful trip. We saw mountain goats, lots of sheep, meadows, and very few people. We lived on crêpes in Bordeaux!

## China

In late 1982 I received an inquiry from WY Chen about working with my group on blood compatible polymers. She was a chemistry professor at Beijing Univ.,

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working on polymers of interest to us. I'd probably requested a reprint copy of her recent paper. After some time she asked to come to *uu*, funded by her institution, at no cost to me or the *uu*. I didn't understand then the strategy of 'self-funded' Chinese visits to foreign labs. I did provide a very small stipend, but it was very difficult for her financially. I learned later that whatever she received had to be 'shared' with authorities in China. I never did learn the details. Her experience in 1984–85 must not have been too bad, because in 1987 I received an invite from her to a conference in Kunming, and a request to lecture in Beijing. Local accommodations would be arranged.

So Barb and I headed to China in May, 1988, a year before the Tiananmen Square protests and crackdown of June 4, 1989.

We traveled via Hawaii and Osaka for conferences and meetings. In Kona, Hawaii I talked about protein adsorption and PEO-treated surfaces. We went to Kyoto and the international biomaterials conference, and had lovely encounters with young Japanese students trying out their English in a large Kyoto park. We visited Taki and Mrs. Matsuda in Osaka, as well as Prof. Irie. Mrs. Matsuda, Yoko, has an anthropology degree from *sf* State. Taki Matsuda was, in my opinion, perhaps the most creative and interesting biocompatibility researcher in the field.

Then it was on to Shanghai; we went easily through customs and passport control, and down a long foggy hall with a smell of mothballs, to a waiting colleague of Dr. Chen's who took us to the Shanghai Academy of Sciences building, which housed foreign visitors. The drive there was along a boulevard shrouded in trees and a thick fog or mist. There was little traffic. It was mysterious, almost eerie, and in a way beautiful. The next morning we were met by another colleague who took us to Nanjing via train.

Our host was Wan Sui-Ren, Nanjing Institute of Technology (*NIT*), who had worked in Art Janata's lab in Salt Lake City. The *NIT* guest house had other foreign visitors – very nice accommodations. My seminar on April 29 was on *STM* and *AFM* – and on Proteins as Engineering Machines. Barb went on a tour with a French lady. We recall being taken to a park and trail with many large animal sculptures and a temple/shrine at the top of the trail. Very scenic and historical. We trained back to Shanghai for the flight to Kunming, which was greatly delayed. We had someone working hard to get us on a plane. We finally boarded. We were each given a small white bag printed *CAAC*.

The Kunming arrival was fine. Our handler-minder was a personable Chinese woman with excellent English and a determined and efficient manner. She was looking for contacts in the USA for her and her husband. We were good targets! Our accommodations in Kunming were very good. I arrived to the International Conference late, thanks to the CAAC delays. The meeting was good with many colleagues, including Hoffman, Brash, Feijen, Barenberg, ...

We were taken to the remarkable Stone Forest and other rural sites near Kunming. From the perspective of our bus seats we could see the rivers of bicycles – huge streams of bikes flowing and merging smoothly among each other and the motorized traffic. It was beautiful.

We experienced the open pit semi-public toilet facilities. Barb said she closed her eyes to avoid viewing other people doing their business. I watched a gardener on campus for a few seconds, marveling at the volume of his solid output – a testament to a high fiber diet. That was of interest because of my own regularity problems while enduring the physiological anxieties of deaning – fortunately largely corrected by an elderly physician's advice to consume a teaspoon of Metamucil per day, with lots of water. It worked.

We then booked a conference tour to Dali, to the northwest, near the Myanmar border. Dali was considered a rural, ethnic village. The rough, highly scenic, very exciting bus ride was 11 hours each way! We stayed in the best hotel in little Dali, which was somewhat uncomfortable. But the sites, the atmosphere, the experience was incredible. We were in a bus and tour full of technical colleagues and had great company. The trip back to Kunming was on the same road, exposing us to the many truck and auto wrecks along the highway! We saw much manual labor along the highway, breaking rocks with sledgehammers, digging large trenches with hand shovels.

Our flight to Xian was cancelled; we had to stay two more days before securing seats on the once a day flight from Kunming to Xian. We learned first hand that the airline's abbreviation CAAC stands for China Airlines Always Cancels! We finally reached the walled city of Xian two days late on May 10; our hosts there hadn't been informed of the delay. They housed us at the Jiatong U's disconcerting guest house. Barb visited a bell tower and stone rubbings demonstration. The next day we took an auto tour to the Terra Cotta warriors site and museum. A remarkable exhibit and education for us. We arranged for us to go to a nearby elementary school and an on campus nursery school. Our round

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eyes were the hit of the students' recess adventure that day. We also visited a traditional Chinese medicine museum and pharmacy. Fascinating.

On May 13 we flew to Beijing, where Dr. Chen and her colleagues met and hosted us. I gave several lectures, Barb visited the summer palace – always with a hostess/minder. We had a Peking duck luncheon. It was fascinating to see the duck 'dissected' before serving – sort of a sledgehammer-like cleaving, leaving bone fragments and jagged edges. We toured the Forbidden City, Tiananmen Square – one year before the uprising that resulted in such killing and agony.

My lectures, in English, of course, were partly illustrated in Chinese via transparencies that my own Chinese and Taiwanese students had prepared. That was quite a hit. The next day, May 15, Barb left for the airport and her flight home. I stayed on lecturing and working with students and professors. At Tsinghua University, sometimes called China's MIT, I talked on biosensors. At Beijing U I gave a set of lectures on ESCA and its applications to our biomaterials work. Chen and I, and her Department Chair, discussed Chinese students and exchange programs, although I made no specific commitments.

On May 19 I headed for Honolulu and the U of Hawaii on the way home. The facility was the Pacific Biomedical Laboratory right on the coast with a great view of Waikiki and Diamond Head. Incredible. I talked with a Dr. Gibbons about marine phytoplankton and bioluminescence. The visit helped fuel my interests in those areas.

## Paria Canyon, via Buckskin Gulch

The morning after getting home from China via Hawaii, Tonio and I headed to Kanab, Utah to meet up with the Hibbs and others for a 4 day backpack through Paria Canyon, beginning with the spectacular Buckskin Gulch access, just east of Kanab. Jet lag be damned. An incredible trip. I had read Edward Abbey's *Desert Solitaire*. As we started on the trail, just a ripple in the sand, and descended deeper and deeper into the growing gulch, eventually becoming

a very narrow, deep slot canyon, I couldn't help thinking of Abbey's chapter on flash floods. At one point we looked up and saw a large log lodged horizontally halfway up the 100 feet high canyon walls, evidence of what flash floods can do in that narrow canyon. Perspective! As we descended into the gorge we ran into water. I remember trying to not get wet, stepping on rocks, etc. to avoid the water. We soon realized that was impossible. We simply had to walk in the water, up to several feet deep. We emerged from Buckskin Gulch to the confluence with the main Paria River and Canyon, camped, and then continued walking.

We spent 4 days and 3 nights on the trail. We found fresh water at several seeps, camped in beautiful settings, listened to canyon wrens, talked, and simply enjoyed the grandeur and the solitude. We eventually reached the confluence with the Colorado River, below Glen Canyon Dam, at the outpost of Lee's Ferry. We ate and drank! And waited for our ride back up through Page, AZ to Kanab and to our parked cars. We wanted to do it again – and did, sort of, some six years later.

## Relocations and Recruitments – Kopecek and Hlady

Vlado and Milena Hlady returned in 1988 with the intention of staying permanently. Milena worked as a librarian at the Kennecott Building on campus before later becoming a special education teacher in the SLC School District. Vlado worked his way from a research faculty position to a tenured position and then to Chair of the Dept. of Bioengineering and a term or two as Director of CBI.

Our guest scientist from the IMC in Prague, Edward Brynda, completed his stay in late 1988. We had a great party for him. Pavla tells the story of taking him and another Czech visitor to southern Utah national parks. They couldn't believe that there was toilet paper in the outdoor restrooms. They went from restroom to restroom to see if they were indeed all so well equipped!

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At a meeting in Mainz, I think in 1986, Henry Kopecek and I sat in the very back of a lecture hall discussing our collective futures. I asked him when? He replied, very soon. So we made plans for him to permanently relocate to uu. This was a difficult and delicate decision. It involved Pavla, of course. Little did we know that the Berlin Wall/Iron Curtain would come down three years later!

My Dean position allowed me to sequester limited resources to help facilitate a salary for him at uu – as a joint position between Engineering and Pharmacy – one of the best ‘gambles’ ever made by the uu. Henry would also have access to CCCD, one of the state’s first Centers of Excellence, founded and administered by sw Kim. Henry had been involved in CCCD projects during his previous visits and stays at the uu.

Henry finally arrived as a permanent member of the uu faculty in late 1988. Pavla Rejmanova, now Mrs. Kopecek (Kopeckova), followed three months later. It wasn’t easy. They each had to leave someone behind: Henry’s daughter, Jana – and Pavla’s son, Tom. Their secure positions in Prague, including their eventual retirement, would be given up. They had very limited resources. But he had a semi-secure position at the uu; they’d have the freedom to apply and develop their creative ideas and incredible skills in a free and open environment.

Senator Orrin Hatch helped pave the way for their visas and eventual Green Cards. We had to assemble a ream or so (each!) of supporting documentation to permit their legal entry to and residence in the USA.

I recall a dinner with Henry and the IMC-Prague Director, Victor Kubanek, in an Emigration Canyon restaurant, when Henry finally told him of his plans to emigrate. Both Henry and I felt bad for Kubanek, who would take much of the heat back in Prague for the loss of Kopecek to the ‘West’.

And then, a year or so later!, the Wall came down. They could now travel and visit their kids without difficulty. Henry was even offered the Directorship of the IMC in Prague! He declined. He summarized the experience in an interview with the uu *Health Sciences Report* magazine in 2001.

## Students, Surfactants, TIRF, and Sensors

Monty Reichert's group included Peter Suci and Jeffrey Ives. They did PhD theses in 1988 and 1990 related to TIRF at interfaces, anti-fluorescein antibodies (thanks to Jim Herron), waveguides and their modeling (thanks to Christensen), and quantitation (thanks to Hlady and Harris). We had developed great interest and expertise in fluorescence-based immunosensing, setting the foundation for a focus on biosensors. In the mid-80s we had worked on fiber-optic immunosensors via the work of Newby and others.

Suzanne Winters defended her PhD in Pharmaceutics in March, 1987. She worked with Kim and me on the use of PEO spacers for the immobilization of heparin on surfaces. Although she graduated, her work was never formally published. We'd all become very busy and simply didn't do the paper revisions and resubmissions needed. Suzanne went on to work at Symbion on artificial hearts and later became the Science Advisor for the Governor of Utah, Michael Leavitt.

David Horseley, working very closely with Jim Herron, finished his MSc work in 1988 on the modeling and 'visualization' of protein adsorption via molecular graphics, using the small, well known model enzyme lysozyme, one of the first proteins whose complete 3 dimensional structure had been determined.

Two very important and comprehensive PhD theses appeared in 1988:

Jinn-Nan Lin's extensive work provided the foundation for our work on immunosensors. He studied the binding of specific antibodies to the optical surfaces, characterized their behavior for specific antigen binding, and assessed on-rate and off-rate behavior – the basic thermodynamics and kinetics of Ab-Ag binding. We addressed the question of dynamic sensor or an integrating dosimeter, first posed to us by Ira Skurnik at DARPA. We were striving to understand how to develop truly continuous antigen sensors, to be able to measure antigen concentration in real time.

Jin Ho Lee continued our interests in blood compatibility via protein passivation by studying a wide array of easily available PEO-containing surfactants. We dubbed the block copolymers 'supersurfactants'. Their use permitted most

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hydrophobic surfaces to be treated via surfactant adsorption to exhibit resistance to protein adsorption

We continued our basic work on hydrogels and on polymer surface dynamics.

We began work on firefly luciferase and its possible application to bioluminescence-based biochemical sensors. Ping Yeh's 1989 MSc thesis on firefly luciferase provided the early foundation for what would become a major effort on biosensors. In late 1988 the UU science reporter, Lee Siegel, interviewed me, resulting in pieces in the *Daily Utah Chronicle* and the *Deseret News* – a major daily newspaper – on our evolving biosensor work.

## Mindy

In the late 80s, we think, I hired Mindy Meservy, a first year UU student as a workstudy assistant. Work study was the Federal financial assistance program to encourage faculty to hire 'needy' students. Mindy qualified. She proved to be incredibly competent and helpful – and pleasant.

Her major project at the time was *Science without Walls* – swow (Chapter 9). She did all the typing and transcribed my voluminous dictations. And she had good art and design skills. She designed and produced many of the graphics used in the swow videos and textbook, in addition to having several demo roles in the videos. Her most memorable clip is when she touched the terminals of a 9V battery to her tongue, demonstrating that low voltage DC is not particularly dangerous, although it can be very uncomfortable!

From 1991–93 Mindy joined many other serious Mormon students on a foreign 'mission' for the LDS Church. She was sent to Italy and worked for 18 months or so collecting and saving souls for Mormonism, albeit beginning to develop serious questions at the time.

She contacted me upon her return; I immediately rehired her. She kindly gave me a colorful, semi-malleable made-in-Italy stick figure Pinnochio, which I still have. She did not fall into the standard Mormon playbook for young college students. Although she 'served' her mission, she questioned her Church and her



marriage. She became an ex-Mormon and divorced her husband, returning to her maiden name, Mindy Meservy. We worked together from 1993–98.

Her major project upon returning in 1993 was the AIMBE conference book: *Bioengineering and the Costs of Health Care* (next chapter). She did nearly everything – office manager, scheduler, secretary, personal assistant, filing, dictation, and graphic designer.

## The High Tatras

In summer 1988 I traveled to Prague for an International Biochemistry conference and then on to the high Tatra Mountains in northern Slovakia. Pavla had a friend who lived and worked at the base of the Tatras. Pavla and Henry took me on a several day hike into and among these beautiful mountains, which in many ways resemble Utah's Wasatch Range due to their steepness and rugged trails. One of our hikes ended on a ridge where we looked north into Poland. I think one of Utah's attractions to outdoor-oriented Czechs was that the Wasatch reminded them of their Tatras.

The jaggedness of the mountains etched a graphical image in my neurons. I had been playing with multi-variate data plotting – so-called 'star', 'radar', or Rose plots. They were simple, easy tools for the plotting and display of multi-variate data.

At the time Ai-Ping Wei was trying to correlate and interrelate a protein's structural nature with its interfacial behavior (surface tension, adsorption,...) – and we were also using the 3-D structure of proteins to aid in the analyses. As the Kopeceks and I talked in the Tatras, we jokingly called our 'star' plots Tatra Plots. And the name stuck. The term provided a semantic visual for our multi-variate interests and concerns. Radar-like plots became a standard means of plotting and analyzing our data. I used the plots in many of my talks and papers. Ai-Ping included most of the Tatra Plot work in his MSc thesis of 1990. He then went on to do PhD work with Jim Herron in Pharmaceuticals, then to a position with 3M, then to his own Agri-business in Davis, Calif., and now an amateur vintner, also in Davis.

## Pork Barrel Politics

In 1987 UU was approached by Cassidy Associates, a Washington, DC firm advocating for Federal funds for university buildings and facilities. The firm had determined that, because of Utah's two strong Republican Senators, Jake Garn and Orrin Hatch, the UU was 'ripe' for significant 'targeted funding' from the Federal government. The media refers to this as 'pork barrel politics'. In spite of Mormons' belief in honesty and fair play, the UU upper administration became immediately interested. We had been asking the Administration for a state appropriation for a BioPolymers Research Building (BPRB) to house CBI and other related programs. I was initially opposed to pork barrel politics, but was soon overruled by Research VP James Brophy and others.

Cassidy, Hatch, and Garn made it happen, and the BPR Center building was officially opened in late 1989 – total cost about \$20 Million. It was located on the upper campus, just south of the Eccles Medical Library, administered jointly between Pharmacy, Engineering, and Medicine. The building housed CBI, CCCD, and later the Dept. of Bioengineering offices, as well as many faculty researchers.

## Chair, Bioengineering

I was appointed Chair of Bioengineering again, effective July 1988, initiating an invigorated seminar program, a Department newsletter called *Bioengineering Spotlight*, a Department Industrial Advisory Board, and a Development Fund-raising effort.

Seminar speakers in 1988 included:

9–6: Herbert Jennissen, Enzyme Adsorption and Chromatography

10–31: Jarmila Janatova, The Complement System

11–18: Henry Sreiber, Conformational Changes of Macromolecules at Surfaces

Seminar speakers in 1989 included:

- 2–15: Paul Hansma, STM and AFM Applied to Biology and Technology
- 3–2: Taki Matsuda, Surface Modification via Photoactive Processes
- 5–25: Dan Urry, The Hydrophobic Effect
- 7–17: J J Pireaux, Polymer Band Structure via XPS
- 11–6: A. Weisenhorn, AFM (with Hansma's group?)

In Jan. 1989 we officially welcomed Jindrich Kopecek as Professor of Bioengineering and Pharmaceutics. CBI had grown to have 12 paying industrial members. We launched a five year plan for Bioengineering: 1989–1994. In February the Industrial Advisory Board was announced, with Vince deCaprio of Becton-Dickinson serving as the first Board co-Chair. We also welcomed Willem Norde of The Netherlands as a visiting professor, giving a short course on Proteins and Interfaces. The *Spotlight* newsletter later profiled Jim Herron's work on Molecular Bioengineering and Biosensors, and noted that CBI now has 21 paid members! In late 1989 Don Lyman retired, becoming Emeritus Professor, and later relocated to the Seattle area.

The 1990 *Spotlight* noted the award of six new B-D sponsored graduate fellowships. The recipients included Steve Kern and Scott Lea. I taught a course with the Dept of Communications on Critical Science Communications, prompted by the UU's cold fusion episode the previous year. We also noted the purchase and installation of a commercial AFM, made possible in part by the new NIH grant by the Hlady-Andrade team. *Spotlight* also published a profile of all the firms represented on our Industrial Advisory Board. We also profiled Karin Caldwell, Stephen Jacobsen, and Willem Kolff.

Thanks to Bruce Houtchens, we offered a seminar series in early 1990 on Health Maintenance in Remote Environments, related to NASA's interests in missions to the Moon and Mars. Bruce died young in 1995. There was also interest in the concept of closed ecosystems (CES), related to sustaining a balanced life support system in a closed environment. Biosphere 2 near Tucson was a project originally meant to demonstrate the viability of closed ecological systems to support and maintain human life.

*Spotlight* also reported on the Huefner-Andrade course, via visiting speakers, on Bioengineering and the Costs of Health Care. George Bugliarello, the last of nine speakers, covered The Future of Biomedical Engineering – a

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visionary presentation. We also had a full general seminar program for 1990, including talks by:

- 9-21: Masuo Aizawa, Optical Biosensors
- 10-19: JC Janson, Protein Chromatography
- 11-2: Lev Blumenfeld, Proteins as Molecular Machines
- 11-20: Dan Urry, Elastomeric Polypeptides

## More Travels

Aaron headed out to Eugene and U of Oregon in Fall, 1988. Barb joined her former Peace Corps Volunteer (PCV) partner Becky Rabanal in Grand Junction and they traveled to Taos, NM, the site of some of their PCV training, for a get together on Sept., 1988, the 25th reunion.

I added another mountain to my travels list in late 1988 – Mt. Fuji, albeit from a distance. I visited Taki Matsuda that December in Osaka, then participated in a conference at a resort at the base of Mt. Fuji, probably organized by Prof. Masuo Aizawa and the MITI Japan bioelectronics group. Then it was on to Seoul and more technical talks.

We spent a cool Christmas, 1988 in Washington, DC with my mother, Erma, and the Hladys, including baby Nikola. Nik got introduced to museums at a very early age.

We worked on competitive protein adsorption, moving from single proteins at interfaces to several and on to the 'Big Twelve' major proteins in plasma, to intact plasma. Vlado and I presented and published *The Big Twelve* at a Croatian conference in 1987 and

*A Domain Approach to the Adsorption of Complex Proteins* at another Croatian conference two years later.

Our group was always into simple means to attempt to visualize complex topics and ideas. Li Feng was an outstanding icon maker and artist, with great sketch and cartooning skills. Mindy Meservy, our group secretary and admin assistant, was also a great cartoonist.

I was very fond of Leo Vroman's perceptive and whimsical sketches of basic and difficult biochemical phenomena – and the people who study them! We adopted the semantic The Vroman Effect to help describe the multi-level complexity of competitive protein adsorption and dynamics at interfaces. I presented 'Vroman Effects, Techniques, and Philosophies', written with Vlado, at a 1991 meeting in Gouda, The Netherlands, in honor of Leo Vroman.

Thanks to Karin Caldwell and her co-workers, CH Ho began to develop and apply high resolution 2-D gel electrophoresis to our protein adsorption work. In 1990 he finished his MSc on using the method to study heparin-binding plasma proteins. He then went on to do a PhD with Vlado on Lipoprotein adsorption on gradient surfaces. He then accepted a position at Fresenius in Ogden, a major hemodialysis products firm, working with Eric Stroup. Ho remained with Fresenius for his entire career.

In April 1989 it was to Sweden via Florida for the Bioscience 89 conference in Malmo; I spoke on Proteins at Interfaces. The Jozefowicz visited in August, 1989, then later Jennissen came, then Addadi from Israel. Lyklema came again in December. I participated in a Monolayers course in Rochester, under the auspices of the American Chemical Society. There I also had discussions with Kodak. We hosted some visitors from 3M in St. Paul that month.

## Gradient Surfaces

Vlado and I had become fascinated with gradient surfaces – where a single surface parameter varies continuously along the linear dimension of a flat solid sample. I think it was our Swedish friends who introduced us to this approach: Golander, Elwing, perhaps Lundstrom, but we picked it up and rapidly developed and applied it. In 1988 H B Lee received a four year international collaboration grant via KOSEF, the Korean National Science Foundation. His group in Daejeon began making gradient surfaces and using them to study cell adhesion.

Rob Scheer, an MSE Department post doc and teaching faculty, worked with me on educational materials and began to develop gradient polymers to aid in the teaching of polymer science principles. Together with our interests

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in the mobility and dynamics of polymer surfaces, we began to talk about the 'intelligence' of polymer surfaces. We also worked on a Lables Lab kit for polymer science courses.

The 80s were a very full and productive decade!

# The 90s – Transition Times

*The 90s – Another Very Full Decade • No New Hypotheses – in the Uintas! • Bioluminescence • Atomic Force Microscopy – Hansma, Lin, Hlady, and Brophy • Sweden, Turkey, France, UK, and USA • Barb's 50th – Surprise! • Research – mid-90s • Luciferase and Bioluminescence • Whitaker Foundation, BMES, and AIMBE • Smith & Nephew (S&N) • More Travels – A Million Miles? • Carl Sagan – 1996 • Bioengineering and Education • Gravity Rules! • Travels mid-1995 • Simplicity – Complexity – Simplicity • Kolff 'Retires' • And More Travels – Barb, Nina, Tonio, Erma • 1996–1998: A 'New' Home • Kids, Bugs, Teaching – and Birds • A New Hip • Going Solar on Mill Creek • The Late 90s • 1999 – The Year for PowerPoint! – and Luciferase • 'Damn, that's Good!' • Teaching*

## The 90s – Another Very Full Decade

**I**N ADDITION TO *Science without Walls*, *Protein Solutions*, and *The Leonardo* – each coming up in a separate chapter – Barb and I bought and remodeled our current home, sold our old home, provided me with a new hip, and continued our extensive travels and explorations. I was doing well career-wise. Our work on and knowledge of biomaterials, interfaces, and biocompatibility was being recognized. I was getting speaking invitations and consulting gigs, and Board appointments. I was even considered by some as an expert of sorts and able to provide perspective in my fields, being asked to organize and conduct conferences and meetings. I also reconsidered my research activities, plans, and future, refocusing my activities on biosensors.

## No New Hypotheses – in the Uintas!

A vibrant, productive scientific career requires new ideas, new hypotheses, new approaches to the study of important and interesting problems or phenomena. I had done that with blood and bio-compatibility, and with polymer surface dynamics and modification – and characterization. We certainly hadn't solved the blood compatibility challenge, but we did help decrease the problem by using PEO and related hydrophilic, low interfacial energy surfaces. I used to complain to Ratner and Hoffman that they were doing biomaterials research without having guiding hypotheses, which was partly correct. They complained back, "Well, what are your new hypotheses?" And, after a time, I didn't have any to offer.

So... on a hike with the Kopeceks, and maybe the Hladys, perhaps in the very late 80s, and likely on Bald Mountain in the Uintas, I said:

"I'm changing research fields – to biosensors."



My group had already been dabbling with the idea of biosensors based partly on the same instrumental approaches we had used for the more basic study of interfaces. These included TIRF, fiber optics, waveguides, and proteins. But I was also becoming interested in bioluminescence and basic metabolism and bioenergetics, including ATP and even NADH, the two key molecules in bioenergetics.

## Bioluminescence

Bioluminescence became a new interest and passion. I read everything I could, watched videos, did homework, met people. I realized it was a perfect tool with which to interest people in science. So it became a growing part of my expanding interests in science education, teacher training, and public science literacy.

During a trip to La Jolla and San Diego I arranged a meeting with William McElroy, former chancellor of UCSD and former Director of the NSF. He was a pioneer in bioluminescence. When he was with John Hopkins U in Baltimore he would pay kids to collect fireflies for him, so he could study and work out the molecular basis of firefly bioluminescence. I had several of his books and wanted to meet him. At the time he was living alone, widowed from Marlene DeLuca his coauthor and partner in much of the bioluminescence work. His home was in La Jolla, very close to UCSD. He was very pleasant and interested in my ideas on using bioluminescence for science education. I marveled at his history of bioluminescence library, including the book by Japanese bioluminescence pioneer Yata Haneda.

In May 1990 I was in Tokyo for an invited lecture. I arranged to visit Yata Haneda in Yokosuka City, Southeast of Tokyo. Haneda had edited *Bioluminescence in Progress*, with FH Johnson, the proceedings of a 1965 conference in Japan. It was a classic; I fortunately managed to own a copy. It covered the remarkable *Cypridina* ostracod – the so-called ‘sea firefly’, which I was using for science education demonstrations. It also included early work by bioluminescence pioneers JW (Woody) Hastings, MJ Cormier, and WD McElroy, as well as papers on the fascinating New Zealand cave glow-worms. Haneda

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was an elder statesman in the field. He was about 83 years old. I was met at the train station by an associate of his, who took me to a restaurant in town where Haneda met us. He was indeed old and somewhat frail, but very interested in having a visitor. After lunch I was escorted through 'his' Yokosuka City Museum, containing a comprehensive set of exhibits on bioluminescent organisms. It was a unique and special opportunity for me to meet and see him. He died some 5 years later.

These visits, and many others, of elder, retired, very senior scientists were important in providing perspective and motivation, and I learned that they enjoyed the visits, discussions, and recognition.

Our work with bioluminescence really began in 1990 with the study of firefly luciferase. PY Yeh studied its interfacial behavior for his MSc. work, followed by CY Wang, whose PhD. work began with interfacial aspects and moved on through to engineered recombinant luciferase, with Russell Stewart. Wang finished his work in late 1996.

I started participating in the International Conferences on Bio- and Chemiluminescence; the 6th Conference in 1990 was in Cambridge, UK. I presented Wang's initial work. That's where I began to meet and learn of the international community fascinated with bioluminescence.

We had two papers at the 1993 meeting in Banff, Alberta, Canada, where it was decided to establish an International Society – called the International Society for Bio- and Chemi-luminescence (ISBC). In 1994 it was back to Cambridge, UK, where I really got to know Phil Stanley and Anthony Campbell, key organizers and facilitators of the meetings.

## **Atomic Force Microscopy – Hansma, Lin, Hlady, and Brophy**

Interactions and collaboration with Paul Hansma at UC Santa Barbara launched us into the new world of  $\Delta$ FM – Atomic Force Microscopy. I don't recall when

or how I met and contacted Hansma, perhaps during a 1987 conference in Ventura or Santa Barbara. He was one of the first of the early STM researchers to apply the method to biological systems and problems. As with others, his STM experience led him to AFM, where he again became the first scientist to use the method for bio-related studies.

After graduation Jinn-Nan stayed on as a postdoc and then Assistant Research Professor, expanding his work into the AFM (atomic force microscope) realm. After we realized how effective AFM could be in directly observing proteins at interfaces, thanks to Paul Hansma's pioneering studies on fibrinogen and fibrin, we entered into a collaboration with him (Thanks, Paul!) to use Herron's anti-fluorescyl monoclonal antibodies in Hansma's lab at UCSB. Lin drove with a set of samples to Santa Barbara, stayed a week or so gathering images and data, and returned to UU, with a Hansma-built AFM on board. Jinn-Nan led and facilitated that study. In early 1990 we published a seminal paper in the journal *Langmuir*: 'Direct Observation of Immunoglobulin Adsorption Dynamics Using the AFM'.

Paul Hansma was born in SLC in 1946. He returned in 1989 to give a remarkable talk on his AFM studies of fibrinogen, complete with video clips of the direct interactions. We were all very impressed, leading to our commitment to AFM and to acquiring an instrument. CBI and the University Instrumentation Committee committed to help provide funds. Paul was very generous with his advice, tutelage, and time. Without his collaboration and interest, we could never have done what we did. Our collaborative work in his lab, together with our own STM and proteins at interfaces experience, resulted in our first NIH grant in the area: 'Observation of Interfacial Processes by Scanning Force Microscopy'. It was one of the very first grants awarded to apply AFM to the study of protein interfacial processes. It was a relatively large three year grant (\$474,778 in direct costs – April 1, 1990 – March 31, 1993 ) with a very good priority score – the best I ever achieved as a Principal Investigator. The work was largely supervised by Vlado and conducted by him, JN Lin, Andrash Pungor, Eric Stroup, and Scott Lea. They did such a great and exciting job, that the grant was renewed over the next 20 years or so with Vlado as Principal Investigator. Stroup, Pungor, and Hlady did some very innovative work using AFM to address the mechanical properties of protein monolayers. Stroup ended up working for Fresenius Medical in Ogden, and did not complete his PhD

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degree. Scott Lea went on to work with Art Janata at the Hanford Lab of the US Dept. of Energy. Russell Stewart continued to work with my group and served as a consultant to PSI (next chapter).

The UU Vice-President for Research, James Brophy, was quite intrigued and supportive. He became quite ill, suffering from pancreatic cancer. Early in our AFM studies and early in his cancer pathology, Brophy suggested we develop an AFM image of proteins arranged to form a block *U*, the UU official logo. We could adsorb proteins to suitable surfaces and literally push them around on the surface – very early nano-manipulation and engineering! We indeed formed a block *U* in 1991, using adsorbed fibrinogen, treated via thrombin, on a mica surface. The image was published in another *Langmuir* paper, in 1992, by AS Lea, A. Pungor, V. Hlady, J.D. Andrade, JN Herron, and EW Voss. We acknowledged Jim Brophy's suggestion as:

“We are grateful to J. Brophy for suggesting the *U* experiment as a graphic way to show the manipulative capabilities of AFM”.

We submitted the paper in early 1991, at about the time Brophy's cancer accelerated. I visited him in the UU Hospital, with a copy of the original image. He smiled and was really quite pleased. He died December, 1991.

I had felt a sort of kinship with him via his textbook, Azaroff and Brophy, *Electronic Processes in Materials*, 1963, a text in one of my senior year courses in materials science at San Jose State. We first met in 1979 when he was appointed the new UU Vice-President for Research. As Research VP he was very helpful during my Dean years in underwriting and supporting the International Symposium on Artificial Organs, honoring Willem Kolff's 75th birthday, Jan. 1986.

## Sweden, Turkey, France, UK, and USA

There was a ‘UCLA’ Conference in Frisco, Colorado on (I think) protein/enzyme drying and stabilization. We were working with trehalose as a drying stabilizer at the time. I also gave lectures at Abbott in Chicago and at Ciba-Geigy in New Jersey, via Bill Good.

A trip in May to Japan had me in Osaka and in Tokyo – at Nihon Univ for an artificial heart symposium and, perhaps, discussions with Idemitsu related to our contract. I also routed south to Yokosuka to meet Dr. Haneda and discuss bioluminescence.

In August it was off to Dusseldorf, then via Boston for the Gordon Conference on Molecular Recognition. Then it was on to London, then Cambridge for the ISBC conference at Downing College.

After a late summer 1990 trek to Mt. Olympus, it was off to Germany to meet with Herbert Jennissen in Essen, then to Sweden – Stockholm and Goteborg. I worked as part of an external committee reviewing Swedish biomaterials research programs, in Lund, Goteborg, and Stockholm.

Summer, 1991 found us on the way to Turkey, for a biomaterials workshop organized by Erhan Pishkin, whom we’d met at the Artificial Heart conference in Berlin many years earlier. We were at a resort hotel in or near Antalya, which is often called the Turkish Riviera. Many of our friends were there, including Allan Hoffman and Hans Elwing. I made friends with the Elwings’ three year old daughter, Nirosha. I gave two talks: a comprehensive report and overview on ‘Proteins at Interfaces’ and an end of conference perspective talk on ‘Needs, Opportunities, and Problems’ in the field, both published a year later in *Clinical Materials*, launched in 1986 as a new international journal by Christina Tanzey Doyle in England. Tanzey made an appearance on these pages as manager of our Surface Analysis Lab in the early 80s. We’ve stayed in touch ever since.

In Turkey we saw ruins, learned some history, and traveled to the Turkish seaside town of Kas, to the Northwest, and then on to Dalaman to catch a regional flight to Istanbul. The bus ride from Kas to Dalaman was very entertaining. It was full of students going home for some religious holidays. The bus

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driver was playing some loud, uninteresting music. Barb wanted to hear some exotic Turkish music. She engaged the students. They finally communicated using the words *dance orientale*. Then they were all interested – even the driver. One of the students was a dancer. The driver stopped the bus so the students could retrieve some cassette tapes from their luggage – the driver enthusiastically played them. One of the tapes induced this young woman to get up and start to dance! Dance Orientale! – gyrating, belly dancing, pseudo-pole dancing. We were rolling through a forested area, lots of curves, speed a bit too fast to be safe. She would gyrate and oscillate with the turns and curves. All were singing, some others even did some modest dancing, all were twitching and tapping. When we reached our destination, the bus driver came over and thanked Barb for getting the music going. So did the students.

Kas was a pleasant town. We were in an upper floor room in a home with a great view of the sea and town. We enjoyed apple tea and meals at a cafe almost on the coast.

In Istanbul we stayed in a not quiet hotel, with lots of dust and construction. We tried to find open markets, including the great market or Grand Bazaar – to no avail. We learned later that we were there during some major religious holiday, meaning much of Istanbul was closed. We did see the Blue Mosque and many other sites. Then it was on to Heraklion, Crete via Athens. We toured Knossos, bussed East to Zakros, rented a loud little moped and scooted around the countryside for a day or so. Then back to Athens and on to Munich, to be with the Kopps in Ebersburg.

Then it was on to Paris and Compeigne for a conference, July, 1991: the 7th International Conference on Surface and Colloid Science. My talk was Adsorption of Complex Proteins at Interfaces. Pierre de Gennes was also there and gave another beautiful keynote talk. I felt confident enough at the time to conclude my talk with the sentence:

“We feel that the adsorption of simple proteins at simple interfaces is qualitatively understood.”

Ai-Ping Wei had completed his MSc. work in early 1991 on model proteins related to surface tension dynamics and protein stability parameters – displayed using multi-parameter plots. His Tatra plots were part of my presentation in June at the workshop in Turkey and in July at the Compeigne Conference.

## Barb's 50th – Surprise!

Barb loves parties – with dancing. She thought herself shy and reserved in high school. She was a bit less shy in Berkeley as we began dating. But she came back from her Colombia PCV experience infused with Latin music and dancing. She brought LP albums with her from Colombia (*Arpa Tropical!*) – and we acquired others. She would dance with friends – Elaine Jarvik, Shahpar Ghodsi, Francoise Hibbs, Milena Hlady. And birthdays are great reasons for a party. So...

On her 50th birthday, Jan. 25, 1992, I organized a surprise birthday party. I asked her friends and sisters to come to SLC – on Jan. 21 – for a surprise 50th. Their tickets were part of Barb's birthday present. They all agreed! So on a cold January late afternoon, her PCV partner, Becky Rabanal, having flown in from Colorado, came to our door at 6009 Highland Dr. and rang the bell. Barb was in the shower. Barb comes out of the shower – and there's Becky. The initial story: she dropped in because she was at a conference in SLC. Becky is a psychiatric nurse and occasionally came to SLC for regional conferences. So the story held.

A little later, with Barb out of the shower and her hair still very wet and unkept, the doorbell rings again. Barb answers and opens to find her two sisters, Jill and Antonia, at the door! They said Happy Birthday, sis! And then Karen Sweeney showed up, and then the locals – Francoise Hibbs, Elaine Jarvik, Shahpar Ghodsi, and Milena Hlady. Denna Wright and Pavla Kopeckova also participated. Barb danced with each and all of them. And with me, too – a Colombian *cumbia* complete with the machete she'd given me – with a lighted candle in her hands – which I was supposed to douse with the machete as I was encircling her. A cool, seductive dance.

I presented a cake with 50 burning candles. The guests all stayed a day or two, danced a great deal, and had a great time. A full and effective surprise birthday celebration!

It may have been at this party that Elaine Toronto gave Barb and me a CD by Madredeus, a currently popular Portuguese band that played sort of new age *fado* music. I really enjoyed their music.

Our 1992 year travel to explore Price and Green River, Utah, resulted in some poetic creativity:

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4-16-1992 – Green River motel song, by Barb:

*When I get back to bed  
You've made that comfy sloping cavity.  
My darling, don't be vain,  
I snuggle 'cause of gravity.*

And that June, in Portland, I recited:

*Querida Barb sits across the table  
Her blue eyes lighting the sky.  
She sips her tea delicately  
While I gaze at her and sigh.*

One day, probably on the way to the West Uintas for some hiking, we stayed with the Wrights just East of Park City. Bob Wright had built a large, energy efficient home, based on a Frank Lloyd Wright design. They were starting to operate it as a bed and breakfast (B&B).

And it was likely in October, 1992 that I fell from a tall ladder while Tonio and I were pruning a tall elm, 'painlessly' injuring my right hip. The pain would appear later, likely exacerbated by energetic macho scything of tall grass in the yard for the next several years.

In December, 1992 we traveled to Maui to participate in Allan Hoffman's 60th birthday festivities. It was our first time in Maui. We visited the Dutras, relatives on my father's side (his cousins) who had a family vacation condo in Maui, near Lahaina and the conference hotel. Barb and I made it to the top of Maui early one morning, to feel the geopresence of that magnificent spot. Barb felt the energy with her hands outspread, like a mountain goddess. It made a great picture!

I gave a brief social comment at the Hoffman symposium, showing a few of our slides of the younger Allan, including one taken nearly two years earlier at the Turkey workshop. I had a small group on a pier with me, looking for bioluminescence one evening. I took a picture of several people bent over the pier, looking down, throwing rocks and sticks into the water to excite the dinoflagellates. Allan was a few feet back on the pier, looking intently at Barb's somewhat raised derriere! I, of course, showed that slide, and told the story of



Allan's rough hand in South Korea, migrating towards our young hostess' thigh. He was a good sport.

## Research – mid-90s

Li Feng did much of his extensive work on pyrolytic carbon surfaces in the early 90s, finishing and receiving his PhD in early 1993. The LTIC (low temperature isotropic carbon) materials were provided by Sorin Biomedica in Saluggia, Italy. Li published five papers 1993–95 in JBMR, the *Journal of Biomedical Materials Research*, on his extensive work – a multi-technique study of the properties of LTIC surfaces. His papers were energized by his clever and very effective sketches of the mechanisms of interfacial processes involving proteins. One of the papers dealt with protein adsorption via 2-D high resolution gel electrophoresis, a very powerful, very time-consuming technique.

His publications had begun in 1988 via STM studies of amino acids and albumin on graphite surfaces, working closely with cz Hu (Chen-Ze). Li helped develop and establish STM and AFM in our labs. He stayed on as a postdoc for several years after his PhD, working on relating the structure and adsorption properties of fibrinogen. He developed a domain model for fibrinogen and expressed it as cartoon or iconic graphics, greatly enhancing explanation, understanding, and application. He then applied those skills to a wider range of proteins, as a paper submitted to *J of Chemical Education*, titled 'An Icon Representation of Protein Structure and Function'. Unfortunately, it was not published – a draft copy is at [joeandrade.org](http://joeandrade.org). A second draft paper, submitted to the *J of Protein Engineering*, applied the icon-domain approach to fibrinogen: 'The Structure and Surface Properties of a Molecular Machine – Fibrinogen'. It was also not published.

In about 1995 Li accepted a position in dental biomaterials in the Chicago area. He suffered a severe debilitating stroke in 2010 and underwent extensive rehab until at least 2018. He may have returned to China.

Kevin Tingey was another very productive student. He worked with us from about 1988–1995, receiving his PhD in early 1995. His was a complex project

on the characterization of a range of polyether urethanes, advancing our protein domain structural and biocompatibility ideas to the complex arena of multi-block polyurethanes. He worked with the Becton-Dickinson (B-D) Company's Vascular Access Division, and collaborated with Kristan Chittur and Mike Gendreau at Battelle Memorial Inst. Both B-D and Battelle provided funding and samples for his work. Only one full paper was published, in *Langmuir*, in 1991. Much of the work in his PhD thesis was not submitted for publication, although I did present parts of it in talks and overview papers. Kevin worked at B-D's Vascular Access facility in Salt Lake City; later he moved to WL Gore in Flagstaff, AZ.

Li Feng's and Kevin Tingey's extensive work on domain approaches to the understanding of protein adsorption were summarized in a large review paper included in a volume edited by Brash and Wojciechowski, *Interfacial Phenomena and Bioproducts*, 1996. That was our last major paper on protein adsorption. We included a final section 'A Plea for Theory' and noted some areas ripe for creative research and exploration.

## Luciferase and Bioluminescence

My interest in bioluminescence as applied to sensing led me to focus on luciferase in about 1991, with Ping Yeh and then CY Wang looking at firefly luciferase purification and characterization. Russell Stewart joined the Bioengineering faculty, about 1995, as the first of several new hires facilitated by our Whitaker Bio-Based Engineering development award.

Russell immediately set about studying proteins as molecular machines, including applying several very new tools, one of which was recombinant protein production and modification.

CY Wang and I introduced Russell to our interests. He agreed to help. So Wang spent many hours working with Russell and his lab partners on recombinant firefly luciferase, including one with a so-called BCCP binding domain,

which then helped with purification and application of the luciferase. BCCP refers to Biotin Carboxyl Carrier Protein. This material became the foundation of our work on firefly luciferase/ATP – based bioluminescence biosensors. CY finished his degree in early 1997 and stayed on as a postdoc and staff scientist at Protein Solutions, Inc. (PSI) for several years. Russell Stewart continued to work with and advise us, including serving as a consultant with PSI.

## Whitaker Foundation, BMES, and AIMBE

In 1975 U. A. Whitaker, the President and major owner of AMP, Inc., was advised by a physician friend to use his accumulated fortune to fund and enhance the nascent engineering sub-discipline of Biomedical Engineering. He did just that. When he died in 1975, the Whitaker Foundation was founded. It began by establishing in the mid-80s a program for funding young bioengineering faculty via competitive grants. Although I was too established at the time to apply, I was asked, probably about 1993, to be a grant reviewer for the Foundation and soon became a member of its Scientific Advisory Committee (SAC). Whitaker paid very well, which was especially helpful in dealing with Tonio and Aaron's college expenses! We met several times a year to review grants and recommend for or against funding. The meetings were always held in very comfortable and pleasant surroundings – including Naples, Florida and La Jolla, California – as well as in Snowbird, Utah. The SAC was a friendly and even social group; we enjoyed our travels and interactions.

SAC-facilitated travel was very helpful, allowing me to visit labs and scientists, and companies in several parts of the country. We would sometimes make 'site visits' to grant applicants, permitting even more diverse travel opportunities.

Serving on the SAC allowed me to meet and work with some fascinating people. One was Bill Brody, the then new President of Johns Hopkins University. He was a very accomplished bioengineer-physician and becoming a very good president. Some years later Lee Huntsman of U of Washington (UW)

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Bioengineering later became president of the uw. I was impressed and wondered if I might be president material – again. I'd already considered it some years earlier when I resigned as Dean.

Perhaps in the mid-90s Whitaker decided to host an annual meeting of its grantees, to provide a means for them to meet, interact, and network. The SAC and Whitaker staff would also attend. There would be an invited lecture or two. And the event was always held in a comfortable location, including La Jolla and Snowbird, Utah. Several of the Whitaker staff, especially Miles Gibbons and Peter Katona, were avid hikers and had a fondness for interesting mountain locations – especially Utah's remarkable Little Cottonwood Canyon.

As a participating 'local' I was asked to organize hikes accessible from Snowbird. Several of us led hikes into Alta/Albion Basin, Sugarloaf Mountain (above Alta and Cecret Lake). We also did one harrowing hike up the slope of Mt. Superior to Cardiac Ridge; Buddy Ratner was in a very tenuous spot on the side of that very steep mountain. Other hikes included White Pine and Red Pine lakes.

I recall walking up to Sugarloaf while talking with Frances Arnold, a young faculty awardee on the CalTech faculty – probably an associate professor at the time and already working on the directed (by her!) evolution of enzymes for practical applications. She was very interested in sustainable energy and related environmental areas. We had a stimulating and creative discussion. Little did we know that I was talking with a future Nobel laureate! She received the Nobel in Chemistry in 2018 for her work on enzyme engineering and directed molecular 'evolution'. She now serves as a science advisor for the Biden Administration, among many other appointments and duties.

The Whitaker Foundation Governing Board had decided already in 1991 to fully disperse its assets by 2005 – to build and nurture the promising but still nascent field of biomedical engineering (BME).

They developed several unique funding initiatives:

Department Development Awards

Special Opportunity Awards

Teaching Materials Awards

Leadership Development Awards,

in addition to the ongoing and expanded new investigators grant program. The Whitaker assets seemed to just keep growing and growing. The Whitaker

Corporation's main product line was fasteners and connectors, critical and important to the burgeoning world of computers and their attached peripherals.

In 1992 I was cochairing uu BioE with Ken Horch. Bio-Based Engineering was chosen as the focus for our 1993 proposal to Whitaker's new Department Development Program. Dick Normann replaced us as Chair in late 1992. The grant was awarded mid-1993 and went on for five years. It had a major influence on the growth and development of the Department. The Bio-Based idea led to new courses, new initiatives, and new faculty and students.

I taught a special topics course in Spring, 1996: From Biology to Engineering: Novel Biological Phenomena with Potential Engineering Applications. There were about 10 students, as I recall, including Steven Kern, who later became a colleague and partner in several grants and projects. I had acquired instructor's (i.e. free) copies of the major freshman biology university textbooks. These are remarkable books – each roughly 1000 pages, richly illustrated, covering the entire field of biology. Each student had to develop a specific project and proposal, after perusing all 1000 pages, looking for 'novel' (to us) biological phenomena which might be applicable to practical bioengineering applications. We had a great time. We looked at photons (bioluminescence, vision, photosynthesis), thermogenesis, drought resistance, water purification, cooling, electro- and magneto-reception – even electric eels!

One of the students (Horst von Recum) suggested we might engineer the next stage of man's evolution via photosynthetic skin – an energetic fusion of plants and animals! To get the increased photosynthetic surface area which might be desirable, we could grow arm-pit webs like tiny wings, which we could unfold when needed. *Homo solaris*?

The bioengineering community was served by BMES – the Biomedical Engineering Society. It had its own journal and annual conferences. We had a session, Bioengineering and the Costs of Health Care, at the 1991 Fall meeting. The papers were by me, Robert Huefner, and Bill Cimino – intended to provide a foundation for bioengineers to deal with health care costs. Huefner's paper reviewed the then very new and innovative Oregon Health Care Plan, being developed by Oregon Governor John Kitzhaber, a physician, and Paige Sipes-Metzler. Huefner and I were very impressed by Kitzhaber and Sipes-Metzler and with what they were accomplishing in Oregon.

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In 1992 I organized and chaired the BMES National Meeting in Salt Lake City, held in October. I worked hard to generate sponsorship and support to help speakers with travel expenses. The conference was held on campus, mainly in the then still new Engineering and Mines Classroom Building (EMCB). We had special lectures by Willem Kolff, Stephen Jacobsen, Pierre Galletti, and Utah's Senator-Astronaut Jake Garn: 'An Astronaut's View of Health in Space'. We had special sessions on Bioengineering and the Costs of Health Care and one on Public Understanding of Science and Engineering. Another special session on Interactions with Industry highlighted Utah's Center of Excellence Program, featuring Karin Caldwell and our own Center for Biopolymers at Interfaces (CBI).

In the early 90s noted bioengineer Robert Nerem and others developed and led an initiative to found the American Institute for Medical and Biological Engineering (AIMBE), modeled somewhat after the National Academy of Sciences (NAS) and of Engineering (NAE). The goal was to provide recognition for the BME field and discipline and to provide a focused political voice. AIMBE formed and has been very successful. Whitaker provided much of the initial and ongoing support for AIMBE, including a Washington, D.C. office and staff.

AIMBE, together with Whitaker and the National Science Foundation, helped catalyze a new NIH Institute: National Institute of Biomedical Imaging and Bioengineering (NIBIB). This was also a major effort of the biomedical imaging and Radiology communities – really a subset of biomedical engineering.

AIMBE organized annual conferences starting in 1992, initially meeting at the NAS Building on the National Mall in DC. I was one of the founding members of AIMBE – a founding 'fellow'. I served as VP for Public Policy for its first several years, as well as the conference organizer and Chairman for the second annual meeting in 1993: *The Future of Health: The Roles of Medical and Biological Engineering*, Washington, D.C., March, 1993.

This was in the early days of the Clinton Administration and even before HillaryCare was proposed. I got word to the White House to try to get Bill to stop in at the meeting during one of his daily jogs on the Mall. They never replied.

My then students Steven Kern and Phil Triolo were participants at the meeting. They used my new video camera (this was 30 years ago!) to record every talk and event. Back in Salt Lake City, one of my unpublished *Science by*

*Seduction* book co-authors did a rough transcription of every talk. I then went through all the text, cut and edited with efficiency and much editorial license, and, working with marvelous Mindy Meservy, produced a summary conference paper for each speaker. I also selected succinct quotations from each one to serve as a 'quotation abstract' for each talk. Each speaker reviewed their transcribed and edited paper before publication.

The volume was originally to be published by the American Chemical Society's Symposium Series, but they backed out (probably not 'chemical' enough for their focus). I scrambled and got the U of Utah Press to take on the project. They did – and produced a very nice, in my opinion, little paperback which indeed captured the essence and flavor of the meeting. The book is online at [joeandrade.org](http://joeandrade.org). The *Science by Seduction* very rough book draft is also at [www.joeandrade.org](http://www.joeandrade.org).

That meeting, and several other meetings and reports, did lead to a unique partnership between the National Science Foundation and the Whitaker Foundation, including launching a special funding initiative on Cost Reducing Health Care Technologies (CRHCT). Our Utah group was successful in securing a significant CRHCT grant in 1997: 'Personal Sensors for the Diagnosis and Management of Metabolic Disorders'. We had three co-Principal Investigators: Robert Huefner, Steven Kern, and myself. The grant's three major sections were Technology (our bioluminescence-based ChemChip project), Economics (work by Huefner, Norman Waitzman, and their economics colleagues on costs of health care issues), and Education (our work with the Utah Science Center, The Leonardo, and the School of Education).

Huefner, the Director and Endowed Chair awardee of the Matheson Center for Health Care Studies, was acquainted with all the major health policy experts in the nation.

We assembled a Clinical Advisory Team (CAT), chaired by Brent James of Intermountain Health Care (IHC), and including Edward Clark, Owen Ash, Charles Brokopp, Howard McQuarrie, Richard Sperry, and others. The terrific National Advisory Board (NAB) was chaired by Edward Clark, and included Philip Lee, Carl Jaffe, Paul Feldstein, Paige Sipes-Metzler, John Wennberg, Barry Zallen, as well as Huefner, Waitzman, Kern, and myself.

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The project ran for two years, involved a set of exciting meetings, and a number of papers. We interacted closely with groups interested in PKU (phenylketonuria) and Diabetes.

The Whitaker Foundation's interest in undergraduate Bioengineering education led to its establishing a Teaching Materials initiative in the mid-90s. This was mainly for the development of 'foundation' textbooks. I served as an advisor and reviewer of proposals and projects in that program. The idea was that the traditional engineering disciplines each had a set of 'classical' texts used for its basic courses. Each of those texts served as inspiration for enhanced and complementary books as well.

Dov Jaron of Drexel U and of NSF nominated me to an Advisory Council of the National Center for Research Resources (NCRR), NIH (1999–2003). NCRR had regular meetings in DC, which provided additional travel and interaction opportunities. I also served on a panel of the National Research Council 1993–95.

## Smith & Nephew (S&N)

A significant and lucrative consulting opportunity happened in the early 90s – service on the new corporate Scientific Advisory Panel (SAP) of the Smith & Nephew Corp., based in London and Hull, England. After a visit by S&N's Alan Suggett to the UT in 1990, I was asked to join their SAP.

I recall Alan's visit clearly. My very indoor, no windows, drab, utilitarian office was shared by Mary McDonald and one of her assistants. Mary and I were setting up the Center for Integrated Science Education (CISE) at the time. I didn't know the purpose of Suggett's visit. I did want to interest S&N in the Center for Biopolymers at Interfaces (CBI) and to consider their joining CBI as a corporate member-sponsor. He was looking at me (which I didn't know), and I was looking at him, mainly for CBI.

I showed Alan my labs and research work, though he seemed to be interested in mainly having a discussion with me. Mary left us to talk. He told me about S&N and their dynamic new President, John Robinson. I talked about my



views and perspectives on the future of biomaterials, including new and novel areas for development. We enjoyed the discussion. Some time later I received an invitation to join s&n's new Scientific Advisory Panel (sAP), which required at least two trips per year, one to the UK, generally London or Manchester, and one elsewhere, usually in the U.S. The travel for s&n allowed me to visit labs and collaborators in Europe. From London I would arrange my trips to cover any of the major European cities of technical interest to me – as well as visit science centers and museums.

The early sAP was chaired by Nancy Lane, a charismatic, energetic Cambridge University cell biologist. Other Cambridge appointees were Bill Bonfield, an expert on orthopedic devices and biomaterials, and Neal Rushton, a very experienced orthopedic surgeon. Others on the Panel were Ian Ward and later Bill Eaglestein and others; Gareth Lloyd-Jones represented the s&n research groups.

Our meetings were held in London, Hull, Cardiff, Memphis, La Jolla, and Boston on a regular basis. s&n was – and is – a very major health and hospital products company, then often called the J&J of Britain. Biomaterials and biocompatibility were key to their ongoing success and development. sAP members were very well compensated for their service. We joke that Tonio's four years at Portland's Reed College – and Aaron's four years at the U of Oregon – were underwritten by s&n – with a Whitaker contribution as well!

Smith & Nephew's sAP met Sept. 1994 in London's great Churchill Hotel. Aaron was working in Geneva at the time for the World Health Organization (WHO). He traveled to London and stayed with me. We were both impressed with the late afternoon service at the top of the hotel. Aaron explored London while I was at some meetings. We then trained together to Bristol, to see the Exploratory – Bristol's original Science Centre, then adjacent to the train station. We explored a unique exhibit – The Stradivarium – which featured ultra-large musical instruments. I was very impressed with the developer and manager of that exhibit, Christopher Challen. Richard Gregory, already a famous vision neurophysiologist, was the brains behind the Bristol Centre. He had visited SF's The Exploratorium some years earlier (Chapter 10) – and decided Bristol needed a similar facility.

Aaron and I trained on to Cardiff so I could visit Techniquet, the remarkable science centre founded and managed by John Bettelstone – another

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wonderful science centre character. Aaron and I went to several pubs, talked, and drank Brains, the popular beer of Wales.

“We’d each like a pint of Brains,” we’d of course say.

Aaron then trained back to London to do more exploring there. I followed a day or two later, I think after doing some work with the s&n Wound Management group in Cardiff. We also explored a London pub or two.

## More Travels – A Million Miles?

It was likely in the 90s that, largely thanks to Whitaker and s&n, Delta Airlines concluded that I’d reached Million Miler status – providing some travel perks. Barb and I liked free first class upgrades, especially when they were surprises. But those days have been over for a long time now.

Barb and I continued our visits to Portland and the Bay Area to see family, vacation, attend meetings and conferences, and do consulting in Santa Barbara, LA, San Diego.

In Summer, 1993 I was to speak at the Pfizer R and D campus, in Groton, Conn. It was very close to the Mystic Aquarium, and to the home of Sandy and Bill Berry, near Bridgeport.

We visited and probably stayed with Sandy and Bill for a day or two. Sandy was one of Barb’s roommates at UC-Berkeley. They have been friends and in touch ever since.

Back in early 1962 Barb invited me for dinner at their Hillegass Ave. apartment – Sandy had left so we could be alone. Barb burned the garlic bread she was making for the spaghetti dinner she’d prepared. Another nice beginning. We’ve been burning toast together ever since.

Sandy and Bill showed us around, took us to Boston, showed us Boston Commons, Walden Pond, and other sites. – and then to their home. We talked, Barb and Sandy talked, mainly about their five girls and our two boys and their studies and accomplishments. I recall they drove us to La Guardia airport.

While on I-95 one of us extracted a cassette tape with some of Aaron's original songs. We played his great "This Blue Heart of Mine" at full volume while rolling west. A great ride.

My work and interests with The Leonardo project (Chapter 10) were aided by our flying to Toronto, visiting the IMAX 3-D film firm in Mississauga, and then to the Ontario Science Center. The next day we rented a car and drove north through a beautiful lakes region to Sudbury, to see Taizo Miake, an early consultant for The Leonardo, and his Science North Centre – meeting the staff and interacting with Taizo and his artist wife, Ann Suzuki. I was very impressed by Science North, and became even more impressed with Taizo and his creative ideas and spirit.

In Dec. 1993 I was off to Sydney, AU to participate in an Asia-Pacific Workshop on Intelligent Materials, organized by Gordon Wallace, who had been introduced to me by Sung Wan Kim. Wallace and I were both interested in the dynamics of polymer surfaces. The title of my talk was 'All Polymers are "Intelligent": Polymer Surface Dynamics'. The trip permitted me to visit science centres in eastern Australia and on New Zealand's North Island (noted in Chapter 10).

May 1994 found Barb, Tonio, and I – together with our friend Lauraine Stephens and two of Tonio's German friends – on the way to Kanab, Utah to do the Paria Canyon trail. Tonio and I had hiked and camped it with the Hibbs and others in 1988. This time we accessed Paria Canyon directly from the then new Highway 89 White House trailhead. It was an easy walk along Paria Creek to its confluence with Buckskin Gulch. We then continued on enjoying the beautiful canyon and trail for several more days. There were some minor adventures stepping around rattlesnakes, and setting a camp away from the creek wash to keep us from experiencing potential minor flooding due to far away thundershowers. Barb and Lauraine loved to walk slowly and smell all the flowers, and see all the birds. I complained that I didn't have that 'low' a slow gear; I needed to keep walking, even with my then bad hip. We hiked to Lee's Ferry, had some lunch, loaded up our trusty Honda Civic Wagon and rolled back to Kanab, via the Glen Canyon Dam visitor center – and home. A very memorable experience.

An August 1994 'trip' was in south Salt Lake City with the Hladys. They introduced us to their interesting friends Max and Wilma Dereta, who wrote and illustrated comic books for kids in Holland. More interestingly, they were

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both skydivers and did aerial photoshoots of skydivers in action! They wanted to jump in Salt Lake City. They looked into the parachuting activities at what was then called SL Regional Airport #2, located about 10 miles south of Salt Lake City. Vlado or Milena told them about my earlier skydiving adventures. They offered to take us parachuting! I found my old Parachutists logbook – last jump was July, 1965, some 29 years earlier. So in August, 1994 Max and I did a tandem jump, for my 53rd birthday! Terrific. Milena also did a tandem jump, perhaps with Wilma. We have video of each of the tandems. A great adventure. I proudly presented my old logbook. The ‘officials’ recognized one of the names in my old entries – by a jumping oldtimer. The Log now shows #38: Utah Sky Ranch, SLC, 8–14–1994. The ‘official’ wrote in the book: ‘Welcome back to skydiving.’ But that was my last jump, I think.

But then, right after turning 70... on Aug. 10, 2011...! Stay tuned.

## Carl Sagan, 1996

Carl Sagan died Dec. 26, 1996; his final words to mankind were published as a collection of essays, posthumously, in 1997: *Billions and Billions: Thoughts on Life and Death at the Brink of the Millenium*. Its final Chapter 19, ‘In the Valley of the Shadow’, are his thoughts on his impending early death. He’d been diagnosed with myelodysplasia, deadly within six months. After having the disease for two years and receiving three bone marrow transplants from his sister, Sagan died from pneumonia at the age of 62 in late 1996. He wrote the final words for the book in Oct. 1996, with an optimistic mindset. He died two months later.

Arthur Koestler’s 1978 memoir, *Janus*, made me well aware of Humanity’s Basic Flaw. I resonated with Koestler’s suggested solution: elixir vitae. The Flaw was covered by Sagan back in 1993 and 1995 in *Shadows of Forgotten Ancestors: A Search for Who We Are* (1993) and *The Demon-Haunted World: Science as a Candle in the Dark* (1995). I wish I had become as aware then as I seem to be now.

## Bioengineering and Education

Karin Caldwell chaired Bioengineering in 1997–1998. She left that June for a Distinguished Professorship at her alma mater, the University of Uppsala in Sweden. Ken Horch and I were appointed co-chairs to replace her. We were publishing a quarterly Department newsletter at the time. Here's what I wrote for the Fall, 1998 edition:

Why does it take two men to do the job of one woman? Well, the Dean, the two co-chairs, and the faculty apparently realize that Ken and Joe each have their good points, and they each have their less-good points, but the good points complement each other. By combining the best of both, we intend to continue the dynamic growth and accomplishments that were initiated and achieved during previous administrations. The future of Bioengineering at Utah is bright.

In the mid-90s there was growing interest and activity in bioengineering undergraduate education and degree programs. Utah had been a graduate-only program. We expected our students to receive their undergrad degree in a 'traditional' engineering discipline or in one of the 'basic' sciences. But the increasing national – and Whitaker Foundation – interests led us to begin considering a bsc. degree in Bioengineering. Ken Horch and Doug Christensen were the faculty most interested. We began by encouraging our sister engineering disciplines to work with us to develop 'Bio-' or 'Bioengineering' minors in their own undergrad curricula. A number of my seminars included the topic of bio-Engineering – the incorporation of biology and physiology principles and examples in all engineering disciplines.

In time our own faculty warmed a bit to the prospect of a full undergrad degree program – as long as it was small and of high quality. Ken, Doug, Rick Rabbitt and Rob MacLeod worked together to outline, develop, and get uu approval for the new degree program. Dean David Pershing was very supportive.

The bsc. degree in Biomedical Engineering was approved in 1998 and our first Freshman class began in Fall, 1999. The program launched with two

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special freshman courses, BioE 1101, 1102: Intro to Bioengineering. Largely designed by Rick Rabbitt, the courses were a rigorous introduction to physical and chemical principles as applied to bioengineering topics and problems. Rick was/is a brilliant teacher – I learned so much by sitting in on his lectures and discussion that Fall, 1999 when BioE 1101 was first offered. I had agreed to teach 1102 in the spring term. The UTU had finally changed to the semester system just a year or two earlier. I had Rick's original outline for 1102 to work with and learn from. I felt somewhat uncomfortable with much of the material. I just didn't have the clear-headed physical foundation Rick had. But I got through it in fair shape.

That Freshman course had about 100 students. Full enrollment in the undergraduate program was limited to 30 or so students. We used the course results, together with other information, to select the third of the students to be admitted to the program – controversial and difficult, but effective.

I did change the 1102 course significantly for the second offering in Spring, 2001. It became a largely projects-based biosensor course, emphasizing metabolism and diagnostics. That coincided with Rupert Davies' and Dan Bartholomeusz's extensive work on bioluminescence-based biosensors, which had a very strong influence on the course. For Spring, 2002 I had the students work on bioengineering-based exhibits for the Utah Science Center. At the end of the course their exhibits were displayed and available to all to visit and use. We had an interactive science center in the Engineering Classroom Building! – for a few days.

## Gravity Rules!

The early 90s helped set the stage for my new hip five years later in 1998. Our huge backyard required near-constant work. Tonio and I were in the backyard pruning and cutting – and, of course, bundling! I was on a 10 foot ladder perched in a fast growing elm tree. We had already cut several large limbs. I had a large pruning shears in my hands, on the very top of the ladder. At that point I was shearing smaller branches, leaned out just a bit too far, and fell backwards

down into the grotch of the tree, adjacent to the ladder. Tonio came immediately. I was in a U-shape, curled within the base of the tree, with the shears under me, point facing upwards! I had just missed the shears. I seemed OK, so we got up, stretched, and later continued working. It was several years later that the lower back pains began.

Bundling became a family tradition. Our waste disposal service would take garden prunings if they were tied into a bundle, roughly 2–3 ft diameter and up to 6 ft long, stacked on the curb adjacent to the garbage can. Larger bundles, or unbundled piles of brush, would not be picked up. So the kids and I would cut, stack, and bundle the large amount of prunings every week. The kids first complained, then endured, and now they nostalgically joke about bundling.

## Travels mid-1995

Barb and I routed to Portland, Seattle and on to Sequim, WA in July, 1995 for a reunion of her high school friends. We then visited and hiked a bit on the Olympic Peninsula with Aaron. We went in to the Olympic Park, did some hiking, visited several coast beaches, and routed down US 101 to Portland across that huge bridge over the Columbia River at Astoria. Aaron participated in an impromptu karaoke session at a local coast cafe-tavern near our motel. We watched and sang along.

The University of Alabama at Birmingham asked me, via Ernest Stokely in Biomedical Engineering, to give a special talk at their Honors Convocation in May, 1995. I wanted to do something significant and different to congratulate and celebrate the honors graduates. Stimulated by the music component of *Science without Walls* (Chapter 9), I chose to discuss and play several songs from contemporary artists who had something very relevant to say about education and society. Given a cassette tape I'd prepared with the various songs, the sound guy in the building housing the Convocation played the various segments as I called for them during my talk. It worked quite well. I began by saying, "I've brought three 'friends' to help me today. Although their statements may be a bit

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out of context, their words help make my point – in an enjoyable and identifiable way.”

Here they are:

Whitney Houston – ‘I believe the children are our future...’

You were the children – now you are the educated adults.

Anne Murray – ‘A Little Good News...’

You are a member of society; YOU must now be involved in addressing its needs and problems...

Sterling Hayden, from his book *Wanderer*, 1963:

‘What does a man need, really need?’

James Taylor – ‘Enjoy the Ride...’

Life is unpredictable, uncertain, leave the world better than you found it.

While in Birmingham I visited (I think?) with Dan Urry as well as the faculty in Biomedical Engineering. Then back to Utah and a Mt. Olympus trek in June!

In August, right after a Whitaker Scientific Advisory Panel meeting at Snowbird, Peter Katona, Miles Gibbons, Henry Kopecek, and I attempted Mt. Timpanagos, approaching from the North via the Timponeke trail. It was rough going – lots of snow. We barely made it to the upper meadow before deciding to give up. Grueling but fantastic.

September found me with s&n in London and Cardiff. I then routed to Oporto, Portugal to chair a panel at the European Biomaterials conference. Tonio flew in from The Netherlands. We spent some time with Manuel Alves da Silva in Porto, rented a car, and then drove to Coimbra, via Buccaco. This time, 16 years later, it was not raining, but in a drought. In Porto Alves da Silva gave Tonio a classic volume of the writings of Camoes. Coimbra found us almost next door to our first pensão apartment where we stayed in 1979. We visited the school where Aaron and Tonio went – it was still there – and the pensão along the main highway where we stayed most of those two months in 1979. That pensão was still there. We talked with the current managers about the senhora who took such good care of us in 1979. Then to Lisboa via the Roman ruins at Conimbriga, where the kids dug for Roman tiles so many years earlier. We finished in Lisbon. Tonio got me to the airport for the flight home, with two large boxes of freshly purchased Portuguese pastries, including natas,



to carry on the plane to Salt Lake City. He returned the car the next day and returned to Holland. I arrived home to a party that was underway, being met at my taxi by Barb and others, expecting fresh imported Portuguese pastries. They were not disappointed!

## Simplicity – Complexity – Simplicity

In 1996 Gilbert Chauvet came into my world. In that year he published his remarkable three volume treatise *Theoretical Systems in Biology*. He was a theoretical physicist working in a medical school in Angiers, France, west of Paris. Barb and I attempted to visit him in Angiers when we were in Paris in mid-July, 1998, staying near the Gare du Lyon. We only had a day in our schedule but it was impossible to get train tickets. The soccer World Cup, July, 1998, was in France. A game was scheduled in Angiers on the day we had available. No tickets, no visit.

I tried to connect Chauvet and deGennes, but I don't think they ever connected.

Chauvet also served as a visiting professor at USC, so I tried to connect him with others on the Whitaker Teaching Materials committee, but the Whitaker advisors had their own foci on bioengineering education, and thus didn't become interested in Chauvet's unique work.

In the late 90s the NSF, thanks to Whitaker encouragement, became interested in funding bioengineering-based projects. So in 1998 we submitted a proposal to the Engineering Research Center (ERC) program titled: Bioengineering Education: From Simplicity to Complexity to 'Simplicity'. Ken Horch, Steve Kern, and I were the co-PI's. Horch and I were just starting our term as co-Chairs of the Department of Bioengineering. The ERC was a large 5 year, \$10M special initiative request. We included Chauvet as a visiting faculty participant and international advisor, as his work helped stimulate our proposal. We were 1 of 7 considered; we were not selected.

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The first page began:

We have a dream. We dream of an integrated, motivated, creative, and practical undergraduate experience which will help students, graduates, faculty, and practitioners evolve the skills and interests to address problems and opportunities in a Renaissance-like ‘conciliate’, holistic manner. We dream of students and colleagues who choose to work on less defined and on complex problems and are stimulated by, indeed addicted to, the intellectual and inventive challenges which such problems demand. Part of our dream involves participants who do not accept the often common attitude in the engineering and education community that renaissance, unitary, conciliate, or holistic approaches equate to superficiality. We believe that the human mind has the capabilities and even the need to develop an integrated coherent view of complex phenomena with as much detail and depth as may be required. We firmly believe that students at all levels are generally inefficiently and inadequately stimulated and motivated, but that their potential for enhanced learning and development is almost infinite.

We will work with groups of appropriately selected students to help them evolve strong background in the basic sciences, mathematics, and engineering at the undergraduate level. They will concurrently develop strong backgrounds in complex, integrated, interdisciplinary projects which will challenge, enhance, and expand their mathematics, scientific, and engineering skills. With their engineering design and project development skills, these engineers will be well equipped to tackle complex bioengineering projects.

We will use a Simplicity to Complexity to ‘Simplicity’ (scs) approach. By this we mean that students will be exposed to topics and projects in a societal context, then rapidly and efficiently apply reductionist principles to break the project down to simple, fundamental, primitive components and models which can be individually studied using their appropriate scientific, mathematical, and engineering background. As background knowledge and expertise are acquired, the simpler building blocks will be connected: the synthesis approach. As those more

complex, multi-component systems are studied and characterized, new tools will be used to facilitate their analysis and understanding. As the project evolves in complexity, students will discover and appreciate that complex systems may exhibit nonlinear characteristics.

As the project proceeds, their enhanced analytical and engineering skills will allow them to evolve guidelines and even sets of rules for their now complex system. This new ‘simplicity’ will not be an extrapolation or additivity of the original simplicity which was achieved by reduction to individual components or building blocks, but rather will be a simplicity achieved by analyzing the now complex system from a different hierarchical perspective. Such experiences will give them the perspective and experience to tackle complex systems and problems in their future endeavors.

We really do want to produce Leonardo da Vinci-like individuals whose creativity, ideas, and inspiration are matured and modulated by engineering ethics and the need to complete and deliver projects on time, under budget, and with enhanced specifications and performance.

Our dream is to produce such unique individuals and to develop faculty and practitioners who can disseminate these experiences and processes to the broader community.

Our goal is to apply this conciliate, renaissance-like approach to undergraduate and graduate bioengineering education. We believe that this will be one of several steps in the significant restructuring and enhancement of Engineering in general. The challenges and problems that our society and civilization must now confront, in our opinion, require nothing less.

Visionary, lofty, naive, unrealistic? Yes! So much for ‘dreams’. And, of course, not funded.

It was only on the last day of 2022, as I was formatting this chapter, that I came across Justice Oliver Wendall Holmes’:

“I wouldn’t give a fig for the simplicity on this side of complexity; I would give my life for the simplicity on the far side of complexity.”

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He was way ahead of us.  
Onward...

## Kolff ‘Retires’

In mid-1997 WJ Kolff formerly retired and left the UU. He and Yanke Kolff relocated to Pt. Townsend, Washington, to live near their son Cass and his family. Lee and Sally Smith held a retirement reception and recognition party in their yard on Sunnyside Ave. that summer of 1997. Pim and Yanke’s marriage was already strained. It’s likely that Yanke wanted to split up, and likely wanted Pim to stay in Utah. She was reported to have said:

“He won’t be a God there (in Port Townsend) – he can’t handle that.” (via Sally Smith).

Shortly after the two of them settled in Port Townsend, Yanke fell and broke her hip. Her negativism towards Pim dramatically escalated, perhaps due in part to the pain and drugs. Pim left in 1999; their divorce was finalized in 2001. It’s all covered in Herman Broers’ *Father of Artificial Organs*, 2020.

## And More Travels – Barb, Nina, Tonio, Erma

May 1997 – Nina and John Ray’s wedding. We traveled with the Kopps from their home in Ebersburg to the wedding site – a small island in Chiemsee, a large lake about 50 miles SE of Munich, at the base of the Bavarian Alps. We stayed on the island in a small nunnery hotel. Parts of the wedding party decided to canoe to the island from the mainland. About half-way across, one of the canoes overturned, with groom to be John Ray and others tumbling into the water. A very memorable trip towards the wedding chapel for John Ray – our new ‘son-in-law’.

After the wedding Nina's real mother and Barb's good friend, Elizabeth, saw us off at the train station back in Ebersburg. We were bound through the Alps for Florence, by way of Verona. Verona was very pleasant, we looked for Romeo and Juliet's balcony, had great cheap wine (Pinot Grigio), and a meal on the plaza downtown. Then it was on to Florence where we probably did some visiting related to da Vinci, but then on through Pisa to Cinque Terre, five small towns right on the Italian Riviera's rugged coast, between La Spezia and Monterosso, more or less midway between Pisa and Genoa.

A 2017 NY Times travel piece gave an appropriate description!

'...the stunning, vertical, gravity-defying cluster of homes that cling to the cliffs of Italy's northwestern coast.'

I don't recall the village we stayed in. The train accessed the villages via tunnels. The train would stop in the tunnel, passengers departed onto a narrow 'station' platform and exited almost directly into the village. The entire village and the sea was brightly displayed as we exited the dark egress tunnel. Spectacular! We had no accommodations. But as we walked into the village, with our small, light bags (and my cane), people came out of the houses and offered directions, accommodations, provisions. Rick Steeves' PBS exposure had created a tourism boom; many homes and buildings were being adjusted, remodeled, modified to serve the influx of new visitors. We quickly settled on a place, dropped our bags there, and began to explore the town – down the many steps toward the center, near the rugged coast. It was difficult but delightful.

It was two years before my new hip. I was enduring via aspirin and Meloxicam, thanks to my doctor buddy in Ebersburg, and by trying to keep up with Barb! We found trails. We walked to the next town up the coast, and probably taxied or trained back. We walked through terraced vineyards, orchards, and vegetable gardens. Lots of steps, walking, some pain, but incredible. But I was now starting to think about an artificial hip. After Cinque Terre, it was by train back to Pisa and on to Rome, then to Rome's da Vinci airport and home.

Erma and I did an interesting trip in August, 1997: We flew from San Jose to Las Vegas, rented a car, and visited Brother Bob at a prison near Nellis Air Force Base, northeast of Las Vegas. We flew back the same day. Bob had done a plea bargain related to renting his land near Yosemite for some illicit drug operations. He and his wife, Joyce, were imprisoned. Bob 'confessed' in a plea deal to insure that Joyce's jail time would be greatly reduced. It was, but Bob got a stiff

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sentence. Erma and I had the opportunity to visit him only this once during his long incarceration.

In early 1998 I visited Tonio, who was working in Leiden, and met some of his fellow student friends, including Jean Kwok, a woman who had worked with Leo Vroman in Brooklyn. She later became a very successful novelist. I was still an internet novice, but Tonio and friends were up to date. We talked about a book I wanted to read: M Scott Peck's *The Road Less Traveled*, dealing with love, values, growth and entropy, and perhaps on evil. So using a dialup modem in his study area, I set up an account on the new and controversial Amazon site – a digital bookstore. They had the book, so I ordered it, using my very suspicious VISA card. It was the first time I ever inputted my Visa number into a computer. What if...??

When I arrived home, the book was at my door in Salt Lake City. Amazing!

A half-year or so later, about June, 1998, Barb and I were in Barcelona, enroute to the island of Majorca. We stayed a night right on the Ramblas, a room with a balcony looking out over the street that almost never sleeps. It was crowded – people, musicians, mimes, tourists, youth...

We went to the science centre, founded and managed by Jorge Wagensburg, who I'd heard speak at an ASTC meeting at OMSI some years earlier in Portland. Wagensburg was dynamic, creative, modern, and inspiring.

We flew over to Majorca, where Tonio met us. He'd been working in the archives in Sevilla.

The Kopps had a vacation home in Majorca, where one of Elizabeth's cousins lived. They showed us much of their island. Their house was very close to the coast. We all went 'swimming' in the little cove below the house, took hikes and walks, saw a meteor shower from their deck, rode a steam train back to Palma.

Tonio and I met up again in Spain in Fall, 1998. He was likely still working in Sevilla; I was routing to the ISBC meeting in Bologna, via Madrid. We stayed together in Madrid, talked, walked, philosophized. Our hotel had a club downstairs with touristy flamenco concerts. We attended one, bought castanets for Barb (they were too big, but she still has them!). We were concerned with saving the world. *Science without Walls* had launched two years earlier. I was very interested in building on its broad perspective, and in doing more to

address environmental challenges and concerns, especially global warming and impending (then) climate change.

At a cafe table on a plaza in Madrid, we started sketching and outlining – building on the ideas and visions for *The Leonardo* and for *Science without Walls*. The Millennium was only a year or so away – so we called our project *The Millennialists Manifesto*.

Tonio told me about Marx-Engels and *The Communist Manifesto* – the idea of a very small, concise, seminal book with a large potential impact. I recalled EF Schumacher's wonderful *A Guide for the Perplexed*; Tonio likely mentioned Maimonides – I read some on him some years later. A very stimulating time. Tonio went back to Seville and to work – I went on to Bologna and the ISBC meeting.

The meeting wasn't very exciting. I soon found an English language bookstore and bought *The Communist Manifesto*: '...a spectre is haunting Europe...' – fascinating. I read, underlined, noted, and wrote in the little book on various plazas and cafes in Bologna. Piazza Marconi was one of them. *Man, the Economy, the Planet* was a working title for what I wanted to write. I built on Jefferson's 'Life, Liberty, and the Pursuit of Happiness'. The outline ended with *The Millennialist's Philosophy* and lastly *The Millennialist's Platform, or Manifesto*. Energy was a major theme. What about a new Democracy! An energy democracy: one man, one vote; one man, one solar energy unit! I'd cover the tyranny of Combustion, the tyranny of Capitalism. My margin notes include "read while ugly, dirty, noisy scooters and cycles are buzzing, polluting the pedestrian areas – ugly echoes in the porticos".

The Gaian Manifesto was another idea, building also on some quotes and material in *Science without Walls*:

Sterling Hayden's 'What does a man need, really need?' (from *Wanderer*),  
George Carlin's *Stuff*, and  
James Lovelock's *Gaia*.

Some months later, on a Whitaker gig in Naples, Florida, Jan. 1999, I continued to ponder our proposed *Millennialist's Manifesto*, continuing to write in the Marx-Engels little book. Over the next decade or so, those thoughts and interests would find their way into *The Call*, *The Run*, and *State Change*.

## 1996–1998: A ‘New’ Home

Barb and I had been looking at homes for about two years. The area around us on South Highland Drive was becoming developed. We also realized that, with my now very faulty hip, we just couldn’t take care of the property without a lot of painful work and anxiety. Our neighbors were being induced to sell their one acre lots and their homes, including our next door neighbor, Mazel Nielson. He informed us that he’d agreed to a deal to sell his home and property – that was after his wife Melba died in March, 1995. We knew we would have to move. We had an informal offer in hand for our place from a Gary Holland LLC, who had purchased the Nielson and Marchant properties just south of us.. So we looked harder. Barb came across a display-like ad for a home with a ‘unique feature’ – Mill Creek ran through the back yard! We’d always dreamt of living near water – on a creek, river, or lake.

So sometime in late summer 1996 we visited the house. It was on a non-descript, normal E-W street – a long, narrow home facing largely south, with a large two car garage.

‘Perfect for solar,’ I thought.

We entered with the seller’s agent through a front door into a ‘breezeway’ – a covered walkway between the house and the garage. We walked in and looked north into the back yard. And there was Mill Creek – flowing some 35 feet or so just slightly below us. Wow! The view, the water, the light, the sounds of flowing water. Yes!

So we visited again a day or so later, with some friends, including an architect friend we had talked with informally. As he walked across the bridge over Mill Creek, connecting the North and South halves of the property, he looked at me:

“If you don’t buy this, I will.”

Elaine Jarvik had brought her real estate agent (who’d helped her select and then buy a home adjacent to public lands in the City – a home that was not for sale!) – the gutsy and effective LuAnn Spiers. I’d been nervous about the asking price, \$190,500, as I recall, which was a little high for the area.

LuAnn said “You two like it? Want it?”

Barb and I responded with an enthusiastic Yes!



“Then offer the full amount, or more. It will go fast. It’s a very unique property.”

We did as she advised, the seller accepted, we bought our second home in Fall, 1996.

On November 24, 1996 we had a party at Highland Drive, to say goodbye to our home of nearly 30 years. We continued to live in 6009 Highland for a few months as we worked on the new home and yard. I was on aspirin to help cut my hip pain. Vlado and Milena helped us clean up the interior, including removing old, very dark, carpet stapled throughout most of the main floor. As Vlado and I knelt on the floor pulling carpet staples from the very good hardwood floor, I kept noticing small bleeding wherever my hands and fingers became even slightly pricked. Later, while peeing, my urine had a very slight pinkish tinge. Even later, I noticed while relieving Puppy one week, that even my semen had a pinkish tinge. I finally realized that perhaps being on high doses of aspirin and Meloxicam clandestinely ‘imported’ from Europe might not be in my best long term interests.

Our Christmas letter for 1996 noted that we would be moving in a few months, and further noted that *Science without Walls* was finally finished and now On The Air. In early 1997 we formalized the sale to Gary Holland; Spring, 1997 we sold much of our now unneeded stuff and moved into 949 Millcreek Way. We received a very good price for 6009 Highland, allowing us to almost immediately pay off the mortgage on the Millcreek property and have funds to perform its much needed interior remodeling. Paradise was now ours. We do miss the spectacular views of Mt. Olympus we saw daily from 6009 Highland Drive.

## Kids, Bugs, Teaching – and Birds

Barb taught at Lincoln Elementary, near downtown Salt Lake City (SLC) for about 10 years, starting roughly in the mid-80s. Her classroom included geckos,

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spiders, insects, and two doves – most there by her choice – and more kids than optimal. We knew Utah was ‘known’ for having very large classes and among the very lowest expenditure per student of any state in the Union – that’s still the case. We did notice after some years of teaching that she was often mildly ill with cold-like symptoms and developed a cough. That was endemic to teaching in Utah, we surmised. All those cute kids carry bacteria and viruses. Elementary teachers try to get close to each student for one-on-one attention and focus. We didn’t wear masks back then. We assumed her situation was more or less normal – at least for Utah.

In the mid-90s she transferred to Nibley Park Elementary, closer to our home. Her health issues continued, so she sought some doctoring. She came under the care of a pulmonologist via St. Mark’s Hospital clinics. He put her on oxygen via a tank and tubing, but she rarely used it. Later Barb had it changed to a small, semi-portable tank, which she used occasionally, especially for hiking. We were both concerned that her lungs might continue to degenerate, so we sought a different pulmonologist.

I had been working on a Search Committee for the Dean of Pharmacy position. Dr. Guy Zimmerman was on the committee. He was a well known, experienced internal medicine and pulmonology physician. We had had a good rapport. So some years later, when Barb chose to see a new pulmonologist, I asked him about her situation. We talked by phone for some time; he asked many questions. He recommended a young colleague, a Dr. Beth Scholand. As we were starting to end the call, he suddenly asked:

“You don’t have any birds in your house, do you?”

I was talking with him from home in our naturally well lit breezeway, as Mr. Dove fluttered in his large cage on top of our refrigerator. Barb often brought him home from school. We had a bead curtain separating the breezeway from the kitchen. It was largely impenetrable for Mr. Dove, so we often let him fly free in the Breezeway. And there he was, perched on a bookshelf, looking at me.

“Well, ah, yes. We often have a dove at home. Barb uses it in her classroom.”

“Well, that’s likely part of her problem,” he said. “They generate a lot of chaf, which many people are sensitive to. We call it Bird Fancier’s Lung. I’d get rid of the dove.”

And so we did. Mr. Dove had been a member of our tiny family. He entertained kids and guests alike. He liked to perch on the head of a visitor

occasionally, leading to several really cool photos. He and his cage found a good home. We thoroughly cleaned the breezeway – and the entire house. Barb contacted Beth Scholland, who's been seeing her for the past 20 years or more.

Barb's condition stabilized; she had a 'mild' case of COPD: Chronic Obstructive Pulmonary Disease. During our 'diagnostic odyssey' we noticed Barb couldn't hike as effortlessly as earlier, especially at higher altitudes. She continued to use supplemental oxygen for a few months, but felt she could just do without more high altitude adventures. She's OK now up to 7,000 ft or so, assuming we walk slowly. We simply curtailed our high altitude activities some 20 years ago.

We considered some 'alternative' therapy. Why not increase her oxygen environment – from the 17% oxygen at Utah's 4,500 ft elevation to the nearly 21% on the Oregon and California coasts? That's a 20% or so increase in ambient oxygen – with no tubes or tanks. And if we stayed at the coast in Dec. – Jan. we'd avoid Utah's then almost ubiquitous winter inversion and its horrible air quality, as well as the icy cold of winter. So we started traveling to the coasts, and other lower elevations – and expanding our Anniversary Adventures.

## A New Hip

I talked with Harold Dunn again, the most experienced local hip surgeon, and a collaborator from our earlier artificial tendon work. I suggested it was time. We had talked extensively about my need for an artificial hip, as my joint cartilage was largely gone, bone was rubbing bone. I'd been walking with very bad posture using a cane – and generally in pain. Hence the aspirin and Meloxicam. This was my first experience with severe pain; the second experience would come some 20 years later.

I knew some about artificial hips, as it was a topic in my Biomaterials courses. I even owned a book titled *The Bone-Biomaterial Interface*, published in 1991. Infection had been a serious problem with early artificial hip surgery; it was still of concern in 1999. The surgery was at the time very highly invasive, involving a foot-long incision and lots of disturbance of muscles and other local tissues.

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I knew of Dunn's earlier concerns with implant-associated infection and the need to modify operating suites with means to provide HEPA-filtration to the air. Dunn was already sketching plans for an Orthopedic Research Center, which he succeeded in opening in 2004 in the UTU Research Park. Dunn assured me that the modern operating suites were all HEPA-equipped and that implant-associated infection was no longer of serious concern. We scheduled surgery for May 27, 1999.

Steve Kern knew everyone in Anesthesiology, and knew a lot about anesthesia. He advised me to have a spinal block. He also advised me to schedule surgery with Dunn in a time slot where the best anesthesiologist was on duty! We did, and it was all fine, although I did need a transfusion of some of the blood I'd set aside earlier.

Steve's office was close to the orthopedic surgery suite; he visited me after surgery and during the several post-op days, even bringing me freshly brewed very strong coffee. I went home some five days after the surgery. Around Day 6 my legs and feet were swollen with some bruising. I consulted with Dunn, who wasn't very concerned. I was taking some pain meds. He did stop by the house on Day 8, in his sports car, to examine my swollen legs. The swelling had subsided somewhat. An ultrasound was done on Day 8 – no issues; just keep leg elevated and get more exercise. By Day 12 I was still in pain, due in part to decreased pain meds and doing more exercise. Day 15 saw me taking Tylenol and not needing pressure socks – much more comfortable. Puppy finally got some overdue attention, a good sign. Two weeks after surgery I was more mobile, we were seeing friends and doing things a bit. I began to use an exercise bike.

Erma had come out to help in early June, staying for some two weeks. On about Day 19 Erma returned to California. After three weeks I was going to my office, in much lower pain, and generally functional, but still trying to keep legs up at night and during the day. I was doing pool exercises. After about one month I was fully functional – driving again, mild hiking. The kids worked with us to purchase some good bikes. I bought a female model so I could mount and dismount more easily. We started bike riding again. By early August we were traveling again – a conference on bone growth in Portland in early August, then Whitaker and s&n gigs – almost back to normal. I was pain-free and cane-free – and could go hiking for 5–6 miles without difficulty. Recovery had required about three months. My hip surgery notes ended on Sept. 14, 1999.

I had expected recovery from surgery would take many months of PT and exercise. I had grown fond of using dictation, thanks to Mindy's expert transcription skills. But, as I would be recuperating at home, marvelous Mindy and others wouldn't be able to help with my productivity. So, well before surgery, I bought Dragon Systems' Professionally Speaking software. It was only functional on an IBM PC platform (no emulators for Macs back then), so I bought an IBM PC to run it, keeping all my other work on the Mac system. It all worked fairly well. Dragon software had me train my voice and speaking skills, so the software could 'learn' my speech. I learned to dictate slowly, succinctly, and with good diction. Some 20 plus years later such capabilities were built into most computers and nearly all smart phones.

My hip worked well, pain was largely gone, I was fully functional – although posture was still not great. Hiking again. Fall, 1999 we visited Suzanne Winters and Bob Ramsey in Escalante, where Suzanne was directing the new Grand Staircase-Escalante National Monument (GSENM) Visitor Center. They took us on a trip into the GSENM to two slot canyons, Peek-A-Boo and Spooky Gulch. My new hip performed well, even wriggling through a narrow slot canyon. As I knew too much about artificial hip wear and particle generation, I used a cane while hiking, to attempt to minimize the load – and thus the wear – of my new right hip.

## Going Solar on Mill Creek

Some years later we began our home remodeling and modifications. We removed a large carport-like overhang on the north side of the house, providing light into what had been a dark patio area. We removed an enormous amount of overgrown ivy on the creek bank and from the wall of the neighbor's shed, which formed our west border, near the house. We had Mr. Window cut a huge hole in our North-facing concrete block bedroom wall, installing a large bay window with a magnificent view of the creek and backyard. We repaired and replaced nearly all of the windows with double-pane windows.

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To make the downstairs more functional, we had a wall-attached ‘Murphy Bed’ installed, allowing a guest to sleep downstairs. I don’t recall the installer’s name – he was the local area Murphy rep we found in the Yellow Pages. He was a small man and did a good job. The bed installation is still very functional, some 25 years later. One time I noticed his quiet wife and three kids were sitting and waiting in his car – for quite some time. We suggested he ask them in to the back yard to enjoy the creek and trees while he worked. He introduced his quiet wife and three quiet boys: Winchester, Colt, Remington or Wesson. He did acknowledge that he was a gun fan. He reminded me of the Sagebrush Rebellion one-armed swindler who had ‘sold us’ the 20 acres in the Oquirrih Mountains some 15–20 years earlier.

A year or so later, after having our roof resealed and retiled, we hired ‘In Cold Water’, an Ogden area solar firm, to install eight solar thermal collectors on the house roof, to fuel a new radiant heating system. Barb and I had become accustomed to radiant heating, via old upright radiators, at 6009 Highland. We did not like the forced air system in our new home. This was a major project. The tubing to feed the hot solution beneath the floor was routed through the existing hot air vents. The job required the installer, Rob Hyatt, to work in the attic, in the downstairs boiler room, and to provide some wall access points to thread the feeder lines throughout the house. The main floor second bedroom closet was walled in to enclose the feeder lines to and from the roof panels to the downstairs boiler room. The installers delivered and installed two 100 gallon hot water storage tanks to fit tightly in the boiler room, behind the boiler, which had been removed. They delivered an integrated solar thermal/gas furnace down our small stairway and into the very small heating room. They hooked it all up – a remarkable amount of plumbing, which – as I write this in Nov. 2021 – and knock on wood – has not leaked.

The heavy solar thermal collectors were mounted right on the south-facing roof. The angle was not optimal for the low winter sun, but it was simpler that way. Mounting at an optimum exposure angle would have required a bulky mounting system. The 15% efficiency decrease, I figured, would be compensated via just one additional collector, eight rather than the seven we originally planned. The roof angle meant the collectors were mounted for optimal solar collection during the summer months, when we didn’t need or want the

heat! For the next two decades I would cover the collectors during the summer months to prevent their overheating.

Barb selected our new bamboo flooring for the solar-heated floors. The solar tubing was all installed before the bamboo flooring. We carefully supervised it all to be sure no errant staple would compromise the solar tubing.

We contracted with Peter Blanchette, a local independent home remodel contractor, to add a downstairs shower adjacent to the existing toilet, to expand our upstairs bathroom, to close in the space between the house and garage – the breezeway – and make other improvements.

And then, after paying all those bills, we did a full kitchen and cabinet remodel. Barb spent a lot of time selecting just the right cabinets, fixtures, and materials for all of the remodeling, resulting in a very functional, pleasant kitchen and bathroom.

So in 2002 we were radiant via solar thermal and very pleased. Our solar thermal system was quite unique. Our home was used in the local, annual solar tour for many years. Some seven or so years later we had the same firm install photovoltaic collectors on the garage roof – eight 220 watt panels, together with a GridPoint inverter and battery backup system. Utah Clean Energy and Salt Lake City used our home, with a ‘typical’ smiling Mormon family in front of it, for its ‘Solar: A New Family Value!’ promotion billboards in 2010.

## The Late 90s

The College of Pharmacy, in 1998, asked me to serve as Interim Chair of its Dept. of Pharmaceutics. Their well aged, largely entrenched, chair had finally agreed to ‘step aside’. The Department needed to readjust and reorganize to recruit a new chair and to move forward. There were administrative and faculty issues to clean up. I reluctantly agreed. I organized and conducted a wide ranging discussion on The Future of Pharmaceutics, with the faculty and some outside participants and advisors. My major accomplishment during that interim term was convincing Henry Kopecek to serve as Chair and to continue to search for a chair from the ‘outside’. I made it clear to him that my ‘interim’

one year term was over and asked him who on the faculty could do the job. We agreed there was no one else we'd trust to take the job. So he reluctantly agreed.

We were finally successful in recruiting David Grainger as Professor and Chair in late 1999; he also accepted an appointment in Bioengineering. Dave was an alumnus of Pharmaceutics, having received his degree in 1987 working with Sung Wan Kim. He had been a full professor of Chemistry at Colorado State University.

## 1999 – The Year for PowerPoint! – and Luciferase

I finally had to learn Bill Gates' remarkable PowerPoint program to produce and present images and videos. Jack Winters was well known in the bioengineering community in the areas of tele-health. We'd interacted via the Whitaker Foundation. He asked me to participate in an FDA workshop he was organizing: Home Care Technologies for the 21st Century, at FDA, Rockville, April, 1999. I realized my days of interactive overhead transparencies had to be over. The workshop would be full of people making presentations via their laptops using PowerPoint. I couldn't be a Luddite in that environment! So I learned PowerPoint, slowly, the hard way. I still use it, even though it's clumsy and clunky compared to the more modern presentation programs available. My first full computer-aided presentation was called 'Chemical Sensors in the Home' – a review of our work on multi-channel biosensors based on bioluminescence. I had just submitted a chapter, 'Toward Dollar Devices for Measuring Metabolic Biochemistry', for a book which appeared later the same year. The talk was very well illustrated. I was no longer a Luddite.

Mr. 'Bear' (Chiung-Sheng Hsiung) completed his PhD work on multi-element analysis via ICP-MS – a collaboration with ARUP Labs. Hsiung took



a position back in Taiwan. He and his work became one of the key chapters in *Science Without Walls*.

One of our grants included modest funds for a seminar series in Fall, 1999. In August we were treated to Thomas O. Baldwin's work on engineered bacterial luciferases. In October Natalya Rapoport's friend from Russia, Lev Blumenfeld, talked on Proteins as Molecular Engines or Machines. We were all stimulated by Lev's then recent book, subtitled *Molecular Machines of the Living Cell*. And in December Bernhard Palsson of UCSD spoke on Metabolic Dynamics. Pedro Mendes also spoke on his simulations of biochemical pathways, a software package called COPASI, which I think we learned about through Palsson. Pedro was Portuguese and recently completed his PhD in England. It was an inspiring series – and very relevant to our biosensor aspirations.

In the late 90s, Dong Min (PhD, August, 1999) began working on bacterial luciferase. Min worked with Baldwin and Russell Stewart on engineered bacterial luciferase and FMN oxidoreductase for our own biosensor applications. Baldwin and Stewart served as members of his Supervisory Committee. Sensing via bacterial luciferase (BL) is a very different process than that using firefly luciferase, which is based on ATP chemistry. BL involved NADH chemistry, which expanded the specific analytical capabilities enormously. We really could now figure out ways to measure nearly all of metabolism. Min worked with Stewart to develop and prepare BCCP – BL and BCCP- FMN-oxidoreductase to facilitate our development of immunosensors using bacterial bioluminescence.

After receiving his PhD Min stayed on as a postdoc for two years working with Russell and me, some of the work related to PSI. He then went on to work on pediatric cancer biomarkers at Mt. Sinai, then years later to Northwestern U to work on oncology proteins. His Masters work at UTU was with Lynn Winterton and Ciba-Vision looking at the denaturability of model proteins. His very first work with me was on preserving dinoflagellates via air drying. We even submitted a paper to the *J. of Phycology* in 1993, but never did a revision to address the reviewer's initial concerns.

## ‘Damn, that’s Good!’

The U of Washington held a conference for prospective bioengineering majors in roughly the late 90s, as I recall. It was organized and chaired by U Washington’s Gerald Pollack, a friend and colleague with common interests in water and gels. Gerry asked me to give an inspirational lecture, basically to encourage prospective students to major in bioengineering – at the U of Washington! It was probably sponsored by the Whitaker Foundation. It was a very important talk for me.

I prepared a multi-media inspirational PowerPoint talk, with video clips from leading bioengineers from the AIMBE 1993 meeting. The highlight, for me, was a clip from the then recent film *Romancing the Stone*. The very beginning shows Kathleen Turner finishing her western romance novel, with Jesse (the hero) on a marvelous horse, rescuing the lovely, sensuous Angelina. Turner visualizes the rescue in her mind – on the screen – crying, as she types ‘The End’. She then stretches in her chair, wipes the tears from her eyes, and exclaims, “My God, that’s good!”

I urged the student attendees to have that kind of passion for their research work, their studies, and their upcoming theses and dissertations – and to communicate it to the general public with passion. Not sure how effective it was, but I really liked it!

Thanks, Gerry – and Kathleen Turner.

## Teaching

Courses, teaching, exams, projects – these were going on nearly all the time. I taught courses in Materials Science and in Bioengineering – on Biomaterials, Surface Science, Polymer Materials, and a range of special topics. Most of my courses required projects, some individual and some via small teams. Most required some type of presentation, most oral, some poster. Many required presentations for general audiences. Several included a current events component,

in later years focused on the *New York Times* and on *Science*, *Nature*, *New Scientist* journals. Most involved some considerations of ethics, values, environmental issues, and planetary responsibilities.

I tried to include demonstrations in the courses. In the basic polymer materials course one term I brought in a hot plate and a pot of water – we cooked spaghetti during class to get at ideas related to long, thin molecules, polymer shapes, entanglement, flexibility, rigidity, even reptation. And we served spaghetti to all willing to try. Another class included a product design competition for a personal, foldable, convenient, reuseable beverage container to substitute for the zillions of disposable plastic cups used by nearly all of us. One time we designed a hydrogen filled backpack assist system using solar energy to electrolyze water to produce the hydrogen needed for the buoyancy lift required. We had some fun most of the time.

I brought in models, simulations, and lots of images, video, and graphics. We rolled in a simple Beckman tabletop infrared spectrometer one time, with a simple recorder output, to demonstrate the IR absorption characteristics of solid polymers – polystyrenes, polymethacrylates, silicones, polycarbonates, polyurethanes. The students could watch the spectra evolve as we discussed the bonds in the various polymers. In their own in class presentations, the students were expected to use demos and other teaching aids. There was always a strong emphasis on presentation and communication skills, including writing, sketches, and body language.

There were special topics courses related to Health Care Costs (with Bob Huefner), Exhibits for the Utah Science Center, Bio-Based Engineering, and on Science Communications.

From mid-1995 to late 1997 I was completely committed to developing and producing *Science without Walls* (Chapter 9) – so much so that I was getting criticism and pushback from the faculty. So I sent a memo to them on April 1, 1996 titled A Personal Update, concluding with the statement:

“I trust that this update might help clarify and justify some of my actions – and perhaps temper some perceptions.”

I addressed my ongoing Extra-Departmental activities, including Protein Solutions, *Science without Walls*, and the Utah Science Center. We were able to rebalance my various commitments and duties to minimize criticism and pushback.

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Here are some of the many courses I taught. Many syllabi and related materials are at [joeandrade.org](http://joeandrade.org) :

- MSE 519 Polymer Materials
- MSE 752 Polymer Surface Analysis
- MSE 792 Materials Science and Biological Systems
- MSE 3410 Polymeric Materials
- MSE 7800, 7801 Graduate Seminar
- BioE 1102 2000–2002 Intro to Bioengineering Semester 2
- BioE 595 Bio-Based Engineering
- BioE 596 Projects USC
- BioE/Comm 695 1990 Critical Science Communications
- BioE 695 1990, 1992 Costs Health Care, with Huefner
- BioE 752 Physical Nature of Surfaces
- BioE 1510 *Science without Walls* 18 years!
- BioE 6040 Advanced Biomaterials, Sensors
- Lib Ed 144, 145 *First Science without Walls* 1996–7
- Engrg 110 Fall 71 De Nevers Technology and Society

# Protein Solutions PSI – 1989–2000

*Beginnings • Bioluminescence • Products! • Bioluminescence on the Road • Presidents and Principal Investigators • Bioluminescence-Based Biosensors • Pulling the Plug*

## Beginnings

**T**HERE WERE LIKELY three things that encouraged me to start a company: my interests in better science education, the local entrepreneurship culture, and having time.

It was never about making money but rather to make unique things available.

Some years after Sung Wan Kim and I self-published our not serious (to us) consulting card, Biomaterials International (BMI) was founded, mid-1981, with McRea as President and Kim as Chair/CEO.

Jim McRea recalled to me, in 2021:

‘...as I recall you, Dr. Kolff, Jan Feijen and Sung Wan were the board of directors/scientific advisory with Sung Wan as chairman and CEO. I believe one of my early assignments included asking Dennis Coleman, Rick Van Wagenen, and Don Gregonis to join as various directors. Lee Smith, I believe,

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was designated as vice-president. We received a stock purchase investment via teletype from Dr. Kolff's arms-dealing brother in Kuala Lumpur!

One of BMI's first products was based on Lee Smith's PhD thesis work. Wet-Tek was a dynamic surface tension measurement device, followed later by a Wilhelmy Plate dynamic surface tension apparatus.

BMI later became Albion Instruments, which was later purchased by Ohmeda. It began doing some contract work, then building and marketing equipment for dynamic wettability measurements, and finally a small Raman spectrometer for anesthesia gas concentration monitoring. The early technology involved intra-cavity laser excitation thanks to the interests of Joel Harris. Lee Smith, Jim McRea, Dennis Coleman, Rick Van Wagenen, and Don Gregonis were all involved. Shortly after BMI was formally founded, I was no longer involved, due to other projects and duties.

In the mid-80s I got more and more interested in applying our optics and sensing experiences to science education activities. Tonio and I discussed starting Flex-Light, Inc. in 1986; we wanted to have a wallet-compatible flat, thin 'flashlight'. This was long before luminescent diodes, LEDs, and smart phones!

Tonio graduated from Cottonwood High in Salt Lake in 1986, with Aaron following in 1988.

Tonio then went to Reed College in Portland, graduating with a BA in Anthropology in Dec. 1991. Aaron attended U of Oregon, Eugene, graduating with BA in Journalism in 1992. We would drive to Portland via Boise – lots of time to talk. Several times Aaron and I routed via Winnemucca and Denio Junction to Lakeview and on to Eugene. We recall our first visit to Denio Junction – similar to the bar scene in *Star Wars*! Interesting characters. Flex-Light and other ideas evolved on several of those long drives.

My growing awareness of protein structure and function, and the concept of proteins as physical and chemical 'machines', made a strong impression on me. Proteins (and, of course, enzymes) are the machines which serve so many biochemical needs.

## Bioluminescence

Protein Solutions, Inc. (PSI) was born in early 1988, with Pete Gerity, Jim McRea, and me as the initial Board of Directors. It began as a science education materials firm, using bioluminescence as a unique means to generate interest, awe, motivation. Some years later it focused on firefly luciferase-facilitated ATP-based biosensors for detection and measurement of biochemicals, and then expanded its sensing repertoire with bacterial luciferase and NADH-based sensing.

I really don't recall the initial motivation to study and apply bioluminescence. It may have come from our fledgling efforts with fluorescent labels. Studying fluorescence leads to studying luminescence, and thus to bioluminescence. Once you experience bioluminescence, it stays with you. I got hooked – wanted to learn and see more and more: fireflies, worms, mushrooms, marine, ...

The real adventure began, probably, with fireflies, which Barb and I had experienced via travels on the East Coast. There were lots of videos, books, magazines: David Attenborough, *National Geographic*... Why no fireflies in Colorado or Utah? But there were. There was a Boulder, Colorado firefly project; later we started the Utah Bioluminescence Project and Contest – and discovered the 'experts' were wrong – there are fireflies in Utah, though not many.

I visited some of the pioneers in firefly bioluminescence, including W. McElroy in La Jolla and Haneda in Japan. I just somehow caught the marine bioluminescence bug.

Barb and I set up a marine aquarium. We talked with a friend of Peter Gerity, Bill Kelley, who helped develop Instant Ocean, a product of Aquarium Systems. He had managed and directed marine aquaria before retiring to Utah.

We explored bioluminescence materials and supplies in standard science education catalogs, especially *Cypridina hilgendorfi* (also called *Vargula hilgendorfi*). It was a tiny ostracod crustacean, about 3 mm in diameter, and often popularly called the 'sea firefly'. We bought it from Carolina Biological Supply. It came as a vial of dehydrated organisms. We ground it to a powder with a little water, producing a bright, beautiful marine blue bioluminescence. It was exhilarating. We studied firefly and cypridina chemistry – each with its own luciferin and luciferase. PY Yeh (MSc, 1990) and CY Wang (PhD, 1997) each did a thesis with me on firefly luciferase, focused on potential biosensor applications.

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Carolina Biological also sold a Firefly Bioluminescence kit, with powdered firefly ‘lantern’ and ATP. Most bioluminescence chemistry involves ATP as the energy source, an enzyme generically called luciferase, and an enzyme substrate, generically luciferin. The ATP-stimulated luciferase reaction produces an oxy-luciferin (an excited molecule), which releases its excitement by emitting a photon – thus, bioluminescence.

ATP is biology’s major energy storage molecule, thus a fuel source, or chemical ‘battery’. ATP is involved in hundreds, likely thousands, of enzyme-facilitated biochemical reactions throughout all of biology, including many of man’s metabolic reactions. All these ATP-enzyme specific reactions lend themselves to the detection and measurement of specific biochemicals of importance to clinical and diagnostic chemistry.

We learned of bioluminescence work around the country and the world.

There was a strong bioluminescence group at the U of Georgia in Athens – Wampler and Cormier. On one of my consulting trips to Atlanta (for Ciba-Vision), I visited Wampler in the pouring Georgia rain!! We discussed ‘his’ worms and thought up a project suitable for PSI.

Back in SLC Suzanne Winters was working with us to help get PSI launched. After discussing Wampler’s worms, we wrote an NSF Phase I SBIR grant for a bioluminescent worm farm – analogous to the very popular Ant Farm educational product. We called it Night Farm. We received our first SBIR grant! So Suzanne went to northern Florida to search for bioluminescent worms with which to start a Worm Farm project. We considered calling the future product Light Crawlers. Unfortunately, our timing was terrible. Northern Florida and Georgia were in a severe drought – and worms were not doing well. Her scientific worm excursion was a bust! We submitted a Phase II grant, creatively expanding beyond worms to a wide array of bioluminescent organisms. But NSF chose not to fund.

I got interested in phytoplankton – becoming fascinated with bioluminescent phytoplankton, especially dinoflagellates (dinos for short). Such primitive and fundamental organisms – much of the foundation for life on Earth – were fascinating. I learned of Harvard’s Woody Hastings’ work on dinoflagellates and, through him, of the Bigelow Lab in Maine – a center for the study and preservation of marine phytoplankton. Hastings had been supervised by McElroy. I bought books, gathered papers, and generally began a total immersion effort



around bioluminescent dinoflagellates. I bought and read much of a then new book by Max Taylor at the Univ. of British Columbia, titled *The Biology of Dinoflagellates*, a treatise published in 1987. I also saw Jim Case at UC Santa Barbara – also Barbara Prezelin there. One of the strains of *Pyrocystis lunula* we were using was first harvested on the little beach on the UCSB campus.

I visited Woody Hastings in Boston and the Bigelow Lab in Boothbay Harbor, Maine in April, 1990, via one of my trips to Boston. It was very informative, meeting key scientists focused on bioluminescent phytoplankton. On the way back to Boston I processed all I'd learned and dictated a full report, including plans for setting up a dinoflagellate culture facility for PSI. Marvelous Mindy Meservy transcribed and prepared the report. *Pyrocystis lunula* became our dino of choice: bright, easy to grow, large and thus easily visible, non-toxic, tolerant to normal, ambient conditions, and had a fairly rapid doubling time – weekly. We secured flasks, lights, timers, racks, and quickly had a facility operational. We confirmed the non-toxicity via a lab Gerity had used in other projects: White Eagle Toxicology Labs.

We arranged for John Tobler, one of PSI's first staff hires, to attend a workshop at the Bigelow Lab to learn how to grow and maintain marine phytoplankton. We had acquired space in the UU Research Park; we set up a culture and growth area in our small lab, set up the fluorescent lights and timers needed; acquired the initial cultures from Bigelow; and began to grow bioluminescent dinos. We loved *Pyrocystis lunula*'s crescent moon (hence the name *lunula*) shape, easily visible via a low power microscope.

Our Bigelow Lab experience had us focus on a so-called Guillard culture medium, which worked well but was a bit expensive and cumbersome. After discussions with Bill Kelley about Instant Ocean and other artificial seawaters, which we called 'non-traditional media', we settled on Instant Ocean enhanced ('fortified') with a small supplement optimized for marine dinos. It worked just fine.

## Products!

We developed NightColony, later NightLife!, as a Bioluminescence Science Kit for commercial sale. It had a colorful thin cardboard backing on which was glued a transparent plastic square-shaped dish. The cardboard backing was colorful, informative, and cleverly designed by Tonio and Vlado Hlady. A small flask with fortified seawater, an instruction brochure designed by Aaron, a pipette, and a coupon – all attached to the cardboard and enclosed by the dish. The buyer was to mail in the coupon so that PSI could mail back a bag of dinos, which were then to be added to the flask. This was cumbersome but it did permit the distribution and selling of kits with a long shelf life. Later the kit included two flasks, one with dinos and the second with seawater containing Lunula Nutrients (fortified artificial sea water) – and instructions for growing and expanding the colony. The kits contained some simple materials and instructions for experiments.

We began selling in 1991 by placing kits in Gregory's, a local toy store, as well as several science center gift shops, including Portland, Oregon's Museum of Science and Industry (OMSI). Lauraine Stephens, our distribution and records person, kept a US map over her desk with pins on every site to which we had sent products. Sales were very limited.

I had published letters and short articles in science education magazines and journals as well as a few ads. That led to inquiries and orders. Dr. Rob Scheer, a recent MSE graduate, joined our group, serving as one of PSI's many Presidents and working on all aspects of the company.

After studying *Pyrocystis lunula* cultures, we realized we could actually maintain the culture in completely sealed polyethylene bags, which were slightly permeable to oxygen and carbon dioxide. These ideas likely came via my interest in closed ecosystems, perhaps stemming from the publicity and popularity of the Biosphere 2 project in Arizona and a Huntsville NASA conference on closed ecosystems. This resulted in Tobler and I presenting talks at the local Utah Academy of Arts and Sciences on 'Culture of Dinoflagellates in Non-traditional Media' and another on 'Culture of *Pyrocystis lunula* in Sealed Polyethylene Bags'. We even submitted a US Patent Application titled 'Culture, Maintenance, Storage, and Transport of Phytoplankton in Sealed

Environments'; that was in 1993, filed via the U of Utah. The effort was abandoned some months later.

We bought a heat sealer, filled polyethylene bags with *P. lumula* cultures, sealed them, called the system Galaxsea (thanks to Elaine Jarvik's suggestion), and made another product. John Tobler, Mara Lisonbee (that was then, she's now Hammer), and Roshen Koshi all were involved in the cultures and in product development and production. Tonio designed the small product brochure for Galaxsea, and a promo postcard. The bags were very convenient. They could travel under mild ambient conditions. The cells could be directly observed in the bags via an optical microscope. And we could, of course, directly see the bioluminescence in the dark, assuming the timing was right.

Marine bioluminescence only works when it's dark – that way you can see it. No point in using energy to make light if there's light all around. That means there's a normal day-night (circadian) cycle for most marine bioluminescent organisms. Bioluminescence is nocturnal. But the cells can be manipulated to alter their cycles – just make their 'day' dark and shine lights on them at night. So we could observe the bioluminescence in our daytime, in the dark, because we 'engineered' their conditioning to be the cells' nighttime (dark) during our 'day'. We built cardboard darkboxes and even darkrooms, and even used a tent covered with black cloth so the inside was nearly pitch black – cozy little spaces to observe and experiment with bioluminescence. We called it Science in the Dark. We published and distributed a small product catalog.

Most of the PSI printed materials are at [www.joeandrade.org](http://www.joeandrade.org), under the PSI tab.

## Bioluminescence on the Road

When I traveled to demonstrate the bioluminescence, we'd first 'condition' the cultures so they would be most active at the time of my visit or demonstration. They could tolerate a day or two without any light, as long as I could regenerate

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them on the other end. So I'd have lights, timers, and space to carry a small bioluminescence lab – a Science in the Dark kit.

The bioluminescence is generally emitted as a result of mechanical disturbances to the cells via water turbulence and rapid movements. Our clients and customers would be asked to – in the dark – shake the bags or the flasks containing the properly pre-conditioned dino cultures.

Such mechanical arousal would result in marine blue bioluminescence and much awe through the eyes and via the brains of those participating.

Thanks to a high school science fair student, we looked into stimulating the dino bioluminescence via a strong audio beat – really! In late 1992 into 93 Aaron put together an audio tape containing some loud, intense drum sequences, some from one of Barb's African Drumming exercise tapes. He took a boom box and just laid the bag on the speaker grill, which was oriented upward. And, in the dark, we went for full volume. The speaker and its screen vibrated, the dinos danced out their emitted light. Another product. We called it Dancing Dinosaurs, with an Aaron-designed product brochure.

On a visit to Vancouver BC to see Science World, the local regional Science Centre, and to meet Geoffrey Ballard, a pioneer in fuel cell development (related to my interests in renewable energy), I also visited Max Taylor at UBC. We talked cordially. I explained our sealed cultures and had him take some bags into a closet so he could observe them in the dark. He came out with a beaming smile – ecstatic. He then ran through his own lab, bag cultures in hand, telling everyone about these dinos living in sealed bags.

On a trip to Miami in 1993, I drove up to Fort Pierce to meet with Edith Widder, then at the Harbor Branch Oceanographic Institution – and already world renowned for her underwater bioluminescence work and photography. She, too, was fascinated by the dinos in sealed baggies, and started her own cultures.

The best demo of all was at the International Conference on Bioluminescence and Chemiluminescence in Cambridge, UK, in 1994. It was at this meeting that an International Society for Bio- and Chemiluminescence (ISBC) was organized and established. Tony Campbell of Cardiff University was one of the cochairs. This was the first conference with a special session on science education. I was scheduled as the first presenter of the session.

Tony and his helpers worked with me to do an in the dark demo during my talk. I had brought a small box full of dinos in bags, pre-synchronized to be at their best during the time of my talk. I arranged their light-dark cycle in our lab before traveling and reinforced it in my hotels in London and Cambridge. Phil Stanley, another of the co-chairs, who had a lab at Cambridge U, was a great help in this regard. So, when I got to the part of my talk on Science in the Dark, I mentioned and showed the dino bags and threw one to Tony, sitting in the front row. The room was bright, he caught it, the audience was now ‘trained’. As I continued to talk, turning off the overhead projector, the room lights slowly dimmed, and then it was very dark – only the door EXIT signs were visible.

And then I asked the audience to play catch. As I picked up and held up a bag of Dancing Dinosaurs, shaking it slightly, the glow was visible to most. We did this about 10 minutes after the lights were out, so everyone was partially dark-adapted. And then after all this conditioning, I simply threw individual bags at the audience – the lower rows, the higher rows, to the left, to the right. As I threw one, it would weakly light up due to the disturbance in the liquid, so many could see the bags in the air. As each bag was caught by someone, it would luminescence brightly in their hands, for a few seconds. They’d then have to shake the bag for the luminescence to persist.

They loved it! Science in the Dark was a hit. I referred them to my conference paper – to be published in the proceedings – for the details if they wanted to grow their own Science in the Dark materials. That was the most enjoyable talk that I ever gave. I also announced the availability of these unique science education materials via Protein Solutions, Inc.

That was probably the same conference where I talked with the bioluminescence bacteria scientists from Krasnoyarsk, Russia. We had previously arranged for them to supply me with their unique bacteria for us to evaluate. They were stored in Stanley’s freezer until it was time to leave Cambridge. I placed the vials and some ice bags in my little red cooler and transported them back to SLC without incident. That was well before 9–11 and COVID pandemics, so such transfers and travel were relatively easy. We had hosted one or two of the Krasnoyarsk scientists at our home sometime in the early 90s. One of them, I think Joseph Gitelson, had a collaboration with Utah State University. Their main interest was luminescent bacteria as a tool for detecting and measuring environmental toxins. They also developed engineered bacterial luciferases

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for sensing applications. – of interest to Dong Min and me for our biosensor applications.

Our sealed bags of *Pyrocystis lunula* were a simple Closed EcoSystem, albeit not fully ‘balanced’. Most of the dancing dinos stopped dancing after a month or more, although some survived and functioned for a year or so.

We tried to place our materials in home aquarium and related hobby outlets. In fact I noted on one such visit that John Tobler had developed quite a commercial and entrepreneurial interest by placing such products under his own label! We had a good talk.

We worked for several years to make the educational world aware of and interested in our unique Science in the Dark products. Our products were listed and displayed in several major science educational products catalogs. Lauraine Stephens began putting more pins on her map of the USA. I accumulated letters and reports from kids using the products in their science fair and other class projects.

We went to several shows, such as the National Education Association (NEA), the National Science Teachers Association (NSTA), and local Utah Teachers Association. But sales remained minimal and the effort was very unprofitable. So we finally phased out the educational products and focused and reoriented PSI towards the development of bioluminescence-based specific chemical sensors, using Federal SBIR grant funding.

As I write this in 2021, some 30 years after PSI began its Science in the Dark efforts, I was pleased to learn of a firm called PyroFarms in Carlsbad, California which sells *Pyrocystis fusiformis* (another bioluminescent dino) in various products for education and entertainment. Perhaps they used some of our experience.

We were also interested in kits to facilitate science education beyond bioluminescence. The general area of optics and simple spectroscopy, of surface tension and chemistry, of plastics and polymers. We proposed and prepared so-called Labless Labs, focusing on kitchen and bathroom supplies for science education. We wrote proposals, via CISE, UTU, and via PSI. Only several very small grants via internal UTU sources were funded. Federal agencies were not interested. Most of our unfunded proposals are in the public domain at [www.joandrade.org](http://www.joandrade.org) for your enjoyment and perhaps application! See the PSI Tab.

Most of PSI's efforts related to science education made their way into the *Science without Walls* television course (Chapter 9) and to the Utah Science Center and The Leonardo (Chapter 10).

## Presidents and Principal Investigators

The Federal SBIR, STTR programs would not allow a University faculty member to serve as PI for a firm which was partnering with the University for such grants. Many such grants involved technology transferred from the U to the firm. I could not serve on PSI's staff AND be on the UTU faculty. PSI's Presidents included:

Suzanne Winters  
Rick Van Wagenen  
Phil Triolo  
Robert Scheer

CY Wang and Li Feng served as PIs.

We were unsuccessful in getting grants related to science or technical education funded. Suzanne Winters served as PI of our first NSF SBIR grant, in 1991, on Night Farms – bioluminescent worms. But all the grants related to:

Plankton Aquaculture  
Dancing Dinos  
Galaxsea  
Lunula Colony  
LightBag  
Light Farm  
Night Lab  
NightLife  
Night Walk  
Lainless Lab

Night Farm  
Night Crawlers  
Night Sea  
Science in the Dark  
went unfunded.

So, in mid-1995 PSI focused its funding efforts on bioluminescence-based biosensors, initially via firefly luciferase-luciferin (ATP) and later to include bacterial luciferase-luciferin (NADH) processes – and focused on SBIRs for funding.

## Bioluminescence- Based Biosensors

Bahar Edrissi, a bioengineering undergrad, prepared a large chart on ATP and NADH-based enzyme reactions, allowing us to conceive of a wide range of specific biosensors. Yeh and Wang's work (1990, 1997) on the ATP platform, and Min's on the NADH platform (1999), formed the foundation for our grants and efforts. Min and Wang were helped by Baldwin and Stewart.

We submitted proposals from 1991 to 2001 to develop specific bioluminescence-based sensors for a variety of metabolites (nearly all unfunded; all proposals are at [www.joeandrade.org](http://www.joeandrade.org) – enjoy!):

ATP  
glucose  
galactose  
GALT enzyme  
lactose  
calcium  
creatinine  
glutathione  
phenylalanine  
lactate  
pyruvate



homocystine  
glycosyl Hb  
monosacharrides  
carbohydrates  
nicotine  
tear analysis  
microbes in air

Phase I proposals on Phenylalanine and Creatinine were funded. We tried hard to get a Phase II for Phenylalanine and one for Creatinine – unsuccessfully.

We considered sensors for cyclosporin and even specific amino acids.

We also submitted several grants related to instrumentation, including camera detection systems.

## Pulling the Plug

By the end of the 90s, I decided PSI wasn't going to get anywhere, so Jim, Peter, and I decided to pull the plug. We donated our equipment and supplies to the UU for use in my lab. We paid all our bills, submitted all required reports, and quietly went out of existence by 2001. We informed everyone involved and invested. We thanked them and apologized that their investment hadn't paid back – that it was completely lost. We even gave away our URL/domain *proteinsolutions.com* to a real Protein Solutions company, at their request. They made instrumentation for characterizing proteins in solution. They were later acquired by *wyatt.com*.

See the Protein Solutions sub-tab at [joeandrade.org](http://joeandrade.org) for more information.

My own biosensor interests and work continued, but now exclusively via my UU Lab. We had the Whitaker/NSF CRCHT grant and an NHLBI grant written largely by Dan Bartholomeusz.

My entrepreneurial 'itch' was well 'scratched'. I had no recurrence of entrepreneur syndrome. Barb and I had put over \$100,000 into PSI over the ten or so years. We did declare and report an investment loss.

Onward...



# ***Science without Walls – 1989–2012***

*Science and the Public • Separating Fact from Fantasy: Investigative Science Reporting • Center for Integrated Science Education (CISE) • Sheila Tobias – They're Not Dumb... They're Different • Science Without Walls (SWOW) • Higher Education Technology Initiative • SWOW – What We Did and How We Did It • Looking Back from Today • Obrigado*

## **Science and the Public**

I TAUGHT GRADE 8 and 9 general science and biology (over 55 years ago!) to a Denver parochial school class with serious disciplinary problems. They had all been expelled from public schools. There was only one way to teach biology: sex. We studied sex from every angle in every part of the plant and animal kingdoms – always with relation to human sex. Their flourishing hormones provided sufficient motivation and relevance. They learned a lot of biology.

I appreciated back then the daVinci quote I learned much later:

‘Learning without a liking for it stills the mind and retains nothing that it takes in,’

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and the much more contemporary Dennis the Menace cartoon where Dennis is watching TV with Dewey. Dennis says:

‘Watch this, Dewey. When that frog thinks he’s got our attention, he’s gonna try to teach us to count or something.’

Although I did well in school – at least until Physics and Russian at Berkeley! – I had trouble ‘getting’, ‘seeing’, and mastering new concepts. It was hard work for me to understand basic math and science principles. I recall how Paul Duncan and Tom Hogan could understand many difficult concepts before I could. Tom could ‘intuit’ the answer to physics questions, while I was still trying to understand the problem. I was drawn to sketches, diagrams, and writing that was expository – that helped me to understand, to internalize, ideas and concepts. Although I have great difficulty drawing and sketching, I loved cartoons, caricatures, comic books. I often made use of Calvin and Hobbs, Gary Larsen, and Doonesbury cartoons in most of my talks and lectures.

It was a decade or so later that I ‘discovered’ Richard Feynman’s Lectures on Physics and even later his advice:

“I had a trick when a book was hard...I’d read the whole article, even though I had stopped understanding it after the first two or three paragraphs. I read the whole article vaguely, and then the next time I’d go through it again and get a little further, and so on, until I went all the way through... then I’d write it in a book... I always had an instinct in reading a complicated book to know what were the essential elements.... There were some articles I never succeeded in understanding.”

I was appointed Dean by David P. Gardner, a few months after his Federal Committee issued its 1983 *A Nation at Risk* report on the state of education. I found the report fascinating and quoted it often in my talks and discussions. My job as Dean required talking with legislators and many others about engineering education and related issues, including basic funding arithmetic. I learned rapidly that many, perhaps most, elected officials – and even some of their staff – had a fundamental deficiency in basic arithmetic and numeracy skills, and of course in general critical thinking skills. This was also the case with many of the other people I encountered, including faculty and administrators throughout the university. Those experiences made me more and more interested in critical science education and literacy.

After deaning, I had some time to get more fully involved in science education issues and projects. Having always been interested in writing and in journalism, especially in high school, I'd continued to read and study highly effective writers and their work. I came across a Jon Franklin and his remarkable book *Writing for Story*, published in 1986, and then his *Molecules of the Mind*, 1987. I read him, looked him up, and wanted to learn from and with him. So, being fairly familiar with National Science Foundation (NSF) funding programs, I talked Jon into letting me apply for an NSF Award to work with him at Oregon State University, where he had recently relocated. He kindly agreed, submitting a strong letter of support to NSF in late 1989. As usual with most of my proposals, NSF said No – so it never happened. This book would surely be much better if I'd had the opportunity to work with him. But then I wouldn't have done a unique course.

In March 1989, several years after I left the deanship, U President Chase Petersen became infatuated with a new 'discovery' from chemistry professor Stan Pons. Stan was a quiet, respected, electrochemist that I'd met via my associations with Art (Jiri) Janata. Stan was working with a visiting professor he'd met during his student days at the U of Southampton: Martin Fleischmann, whom I knew of via his work in Raman spectroscopy. The UU held a press conference on March 23 reporting their discovery to the media – THE major scientific event of early 1989. Pons and Fleischmann's 'observation' of fusion at room ('cold') temperatures was a literally stellar report which shook up the entire world of physics.

Convinced by Pons and Fleischmann that the phenomenon was real, and realizing that it would literally revolutionize the worlds of engineering, commerce, and economics, Pres. Petersen easily and immediately subscribed to the vision. Too easily. The 'evidence', the 'data', were sketchy at best. It was a classical case of scientific wishful thinking, followed by sloppy experiments, and finishing with a non-critical, emotional, selective interpretation of the data. Irving Langmuir, a famous surface chemist, had written decades earlier of such 'pathological science'.

In the meantime Petersen and others had convinced the State Legislature to meet in emergency session August, 1989 to fund a revolutionary Cold Fusion Institute at the UU. The State provided \$4.5M. Thousands of physicists around the world redirected their work to the electrochemistry of cold fusion. Palladium

prices soared. The press went crazy. But it was not to be. Cold Fusion was scientifically dead by very late 1989. Petersen resigned in 1991 in part due to the criticism Utah and its University endured during the cold fusion 'episode'. Pons also resigned. Pons and Fleischmann continued to believe and continued their work in France at a Toyota-funded Lab. The UTU Cold Fusion Inst. closed in June, 1991. See Cold Fusion in Wikipedia. The cold fusion debacle, together with earlier press and PR from the UTU on x-ray lasers and the artificial heart, resulted in such uncritical scientific 'discoveries' being dubbed The Utah Effect.

## Separating Fact from Fantasy: Investigative Science Reporting

In late 1989, stimulated by the cold fusion episode and by my ongoing interests, I worked with the Dept. of Journalism to offer a dual-listed (with Bioengineering, which I chaired at the time) course on Critical Science Communication. It was a twice weekly 4 credit course, held from 4 to 6:30 pm. There were about 15 formal students as well as other attendees, including several local reporters and writers. We read many science papers and tracked their mentions and history in the media, as well as several books related to science journalism (Friedman, Dunwoody, Nelkin).

Visiting lecturers and discussants for the course included:

Pam Fogle – she wrote and released the U's Cold Fusion press release and had to deal with its repercussions;

Ed Yates – science reporter for KSL TV shared and discussed his stories and video clips on the subject;

Cecil Samuelson, Dean of Medicine (and much later President of BYU) covered media aspects of the 1983 Barney Clark – Jarvik – Kolff artificial heart story, together with John Dwan, media relations for UTU Medical Center;

Jon Holbrook – UTU Internal Medicine – discussed the issue of tobacco, health, and media.

There were others related to scientific testimony, advertising, law, etc., including a set of panel discussions. Elaine Jarvik and several of her *Deseret News* coworkers were regular attendees.

I really enjoyed it. I had intended to offer the course each year, but it didn't happen. Five of the students continued with me to draft a well illustrated book titled *Science by Seduction – Communicating with the (Initially) Disinterested*. We met and worked on it semi-regularly for the next two years. I hired several part-time cartoonists to provide very understandable cartoons. A rough draft is available at [joeandrade.org](http://joeandrade.org).

Science by Seduction became a slogan for our efforts.

## Center for Integrated Science Education (CISE)

I became interested in our School of Education, in teacher training, and in the Utah State Office of Education (USOE). I became interested in the Hansen Planetarium, the Utah Museum of Natural History, and The Children's Museum of Utah – as well as other so-called 'informal' science education institutions world-wide.

Carl Sagan's *Cosmos* appeared on public television in 1980–81. It reached a very large audience, was generally very well reviewed and praised, and served as an inspiration for our own efforts on critical thinking and science education.

In 1974 James Lovelock and Lynn Margulis had teamed up to publish the *Gaia Hypothesis*, encouraging discussion of our living planet and atmospheric homeostasis – a remarkable and surprising idea in its time. In the very late 70s Lovelock published his seminal *Gaia: A New Look at Life on Earth*, 1979. It was followed by *The Ages of Gaia: A Biography of our Living Earth* in 1988. I was deeply affected by his ideas and began to follow his works and writings – and those of Margulis.

Mary Rogan (then McDonald) was serving as my secretary and personal assistant. Mary was very interested in and committed to science education. She

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was enrolled in the Bachelor of University Studies degree program, wherein the student is permitted, with some faculty input, to design her own undergrad degree program. I don't recall how or why she found me; I ended up serving on her faculty advisory committee.

We started interacting with several science-interested faculty in the School of Education. I met the people in Chemistry and Physics interested and active in undergraduate education. Physics had Sid Rudolph and Ziggy Peacock. They taught various class 'sections', worked with the Utah Science Teachers Association (USTA), were members of the American Association of Physics Teachers (AAPT), and did demos for physics professors teaching large lecture classes. I also interacted with Tom Richmond who had related responsibilities in Chemistry.

AAAS issued its Project 2061 Science for all Americans report in 1991, emphasizing critical science concepts and themes. Mary and I worked with Trish Stoddart and Julie Gess-Newsome of the School of Education to establish a Center for Integrated Science Education (CISE) as a formal UTU Center. There was some gentle pushback from the College of Science, as they didn't like 'Engineering' working on 'integrated science education'. My argument was someone should do this, so we will. CISE was approved. Mary was soon managing and basically operating CISE. I contributed ideas, general direction, and research grant proposals – most unfunded.

We submitted a proposal to the still new State Centers of Excellence program for CISE support. It was not funded. Mary and James Biggs, probably a work-study student at the time (he later received a PhD in Bioengineering under Ken Horch), worked with me on science education ideas. The AAAS Project 2061 book provided a resource, a stimulus, and media awareness for our efforts. With CISE, the UTU began to develop a greater commitment to science education. At the time there was little interaction between the Colleges of Science and Education. We helped catalyze it. We worked with the USOE's science curriculum person, Brett Moulding, to provide input on the new state science core curriculum.

We wrote many proposals – almost all unfunded. The State, HHMI, FIPSE, NSF all chose not to fund. We did receive some locally administered funding, including Eisenhower grants via USOE.



We also received a Dreyfus Foundation award in 1993 to develop Elem-Net, a FAX science education newsletter for all Utah elementary schools (well before email and the internet!).

Elem-Net was produced and distributed for many years (copies at [joandrade.org](http://joandrade.org), see CISE).

It focused on Chemistry activities at the beginning (Dreyfus funded projects connected with Chemistry); later we changed the name to Explore!, covering all areas of science. Mary McDonald and her student helpers carried out activities through the 90s and into 2001.

During that time we developed and conducted courses and workshops for practicing teachers (so-called inservice courses), using USOE and other local funds. Most of the courses were focused on Integrated Concepts and Themes, based largely on the Project 2061 report. I made extensive use of bioluminescence-based experiments and demonstrations in my inservice courses and workshops.

We collaborated with Leonardo on Wheels, Protein Solutions, the Utah Science Center, and TCMU – the Childrens’ Museum of Utah – in activities, discussions, and proposals – nearly all unfunded! We were influenced by da Vinci, Sheila Tobias, Leon Lederman, Carl Sagan, James Lovelock, Lynn Margulis, and many others.

## Sheila Tobias – They’re Not Dumb... They’re Different

Today is 9–11–2022 – 21 years after the terrorist attacks which empowered George Bush, Dick Cheney, and turned our nation into a largely fearful and closed nation-state. It also catalyzed the Republican War on Science – and on reality itself. We have yet to recover.

And today’s New York Times includes the obituary for Sheila Tobias, 86, who studied math and science ‘anxiety’.

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Her little book *They're Not Dumb, They're Different* appeared in 1990. It was a small book published by Research Corporation in Tucson. I still have it. She was studying math and science 'anxiety' among students who do poorly in such courses, and then drop out of the subjects altogether – especially women and girls. For one of her projects she recruited and paid liberal arts graduates to 'seriously audit' first-year college science courses and to report back their experiences and impressions on 'classroom culture' and professors' teaching methods and skills. Fascinating, but... She documented what we in science basically already knew – and what I had experienced in that first semester physics course at Berkeley: science courses are taught for science majors and future scientists, not for 'others'.

Tobias spoke in the Physics Dept. at uu in Feb. 1992: 'What makes Physics Hard and What can we learn from the Learner.' She also spoke the next month at the first Gordon Conference on Science Education, perhaps in Santa Barbara, discussing science education reform, the 'second tier' of students, and her research results. One of her liberal art graduates who served as a freshman physics auditor said:

'Too many scales, not enough music.'

She was a major voice and force for improving science and math education. I may have met her at the Santa Barbara conference and/or at her uu Physics seminar. She was a strong influence on my interests and activities in science education and literacy.

## ***Science Without Walls (SWOW)***

A major opportunity to work on science education appeared in early 1994. I was encouraged to apply for the 1994–95 University Professorship. This was an annual faculty award to develop courses and activities to facilitate general and liberal education for undergraduates. My interests and activities with the School of Education and CISE had prompted interest and discussion in

improving science education for university undergrads as well as for students in education. The award was a small grant and a year of teaching relief from my ‘home’ department for the 1994–95 academic year. It also connected me to the ‘liberal’ studies and undergraduate education programs, and to Jack Newell and Slava Lubomudrov. Interactions with them helped increase my confidence in dealing with science and society topics.

So I developed *Science without Walls*, a two term course, subtitled Science in *your* World. It complemented my interests in public science education, including the Utah Science Center and The Leonardo. I ran ads in the Utah Daily Chronicle, our student newspaper, to inform students. The ads referred to ‘Science for the Science-Resistant’. The reading list included Shlain’s *Art and Physics*, AAAA’s Science for all Americans report, and two children’s science books: Allison’s *Blood and Guts* and Stangl’s *Science Toolbox*. The course was also greatly influenced by Carl Sagan’s *Cosmos* public television series (1980) and then later by EO Wilson’s remarkable *Consilience: The Unity of Knowledge*, in 1998.

The courses were designated Liberal Education 144 and 145, and offered in the Winter 1994 and Spring 1995 terms to about 30 or so students. They were projects-based courses, including projects for the Utah Science Center. Students were graded on their group project, as well as on their individual projects. It also involved the Labless Lab ideas we had developed. Students were required to maintain their own personal science notebook, with their daily and weekly observations and ideas – like Leonardo da Vinci. The notebook was turned in with their final examination. The final exam included a component from our Labless Lab kit, requiring the student to do a short experiment, make observations, and produce a very brief report – all as a part of the final exam. It was initially a 5 hour/week course, required lots of work, and was fairly successful. I learned a great deal!

A seminar series was also organized and offered during the Spring, 1995 course.

Speakers included:

Leonard Shlain, 3–31-1995, author of *Art and Physics: Parallel Visions in Space and Time*;

Rosalie Pratt, 4–5-1995, BYU Professor, Biofeedback, Music and Well-Being;

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Ilan Chabay, 4-18-1995, Real, not virtual, Phenomena for Learning Science.

I also spoke, on May 5, 1995, on The Leonardo – Utah’s 21st Century Center for Discovery and Learning.

Attendance was sparse at best!

Ilan Chabay had visited two years earlier, spending two days as a CISE seminar discussant on designing and building interactive hands-on exhibits and activities. He had founded and run The New Curiosity Shop, an exhibits firm in Mountain View, Ca.; he’d also served on The Exploratorium staff.

# Governor Leavitt’s HETI Initiative

Mike Leavitt was elected Governor of Utah in 1992. He was young, dynamic, optimistic, as well as somewhat naive about education and technology. He got the Legislature – by saying ‘invest less in bricks and mortar, and more in technology’ – to pass and fund the HETI program: the Higher Education Technology Initiative, and began his quest for a virtual university, soon to be called the Western Governors’ University (WGU). <https://www.wgu.edu/about/story/history.html>. HETI requested proposals for TV-based courses appropriate to ‘virtual’ learning. We did have ‘distance learning’ educational television via the UU, and even a state-wide broadcast TV Channel 9, which was managed in part by the Utah Public Broadcasting folks at Channel 7. And, I had just finished developing and teaching Lib Ed 144 and was beginning Lib Ed 145,...

So, on Jan. 13, 1995, the UU, via CISE, submitted a proposal to HETI called: *Science without Walls: Art*. It was proposed to be the first of a 2 part series; the second part was suggested as *Science without Walls: Music*, to be proposed and developed later. The proposal discussed the need for interest-based education, citing da Vinci’s famous quote:

‘Learning without a liking for it stills the mind and retains nothing that it takes in.’

It also discussed our ideas on Science by Seduction, Howard Gardner's Frames of Reference, David P. Gardner's *A Nation at Risk*, and the AAAS report's focus on concepts and themes. While writing this section in 2021, I reviewed the original HETI proposal – I am impressed some 30 years later!

We also referred to Sheila Tobias' work and book on the need to consider students' interests. Barb helped as I cited her in the proposal regarding my skills: '...reputed by his wife to be completely tone deaf and incapable of dealing with primary colors, he does enjoy listening to music, and has occasionally made some limited, but futile, attempts to produce art.'

She forgot to add that I love cartoons.

The HETI program was administered by Wayne Peay, who served as the U's Eccles Medical Library chief librarian. Wayne was very experienced and knowledgeable in the use of modern technologies in medicine and medical education. We were sort of soulmates in this regard.

We asked for about \$68K, with a UU match of \$18K. It was approved and funded effective 3-1995. This was a big deal – for me, for the Telecourse/Distance Learning program, and for Media Solutions, the U's group with the skills and expertise for educational television. We were to produce a syllabus, a textbook, 20 half-hour TV programs, and a lab component called Science through Art. We played the spin-off company and tech entrepreneurship 'card' by referring to PSI and its Labless Lab and science educational products interests.

The UU committed, I committed, and the next two years of my life were the most intense I've experienced. And the most intellectually expanding and rewarding.

*Science without Walls*: Science in YOUR World morphed into 40 half-hour programs, probably cost the UU close to \$200K to produce, and got me, via Barb, to commit to some new clothes!

From about mid-1995 to mid-1997 swow was my more than full time job. I had to withdraw from The Leonardo project, from nearly all UU teaching, and from much of society in order to plan, write, and deliver. Mindy Meservy, Mary McDonald, and James Biggs were very much involved, as were many of my students and coworkers.

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Aaron was also closely involved. He designed, did the layout, and all but printed the textbook. Aaron and Tonio helped me select much of the music used at the end of each episode.

CISE was already working on our Labless Lab ideas to encourage more hands on, self-discovery approaches to science education. We discussed Science through Art and Science through Music kits, building upon many of the ideas and discussions via the Utah Science Center/ The Leonardo. We were inspired by Klutz Press' *A Science Museum in a Book* product.

*Science without Walls* premiered on Utah's Channel 9 on Tuesday evenings, beginning Oct. 1, 1996, at prime time, 7–9 pm, for the 10 week academic quarter. The local *Deseret News* feature writer – and our close friend! – Elaine Jarvik, ran a promo feature on Sept. 26, with the headline Bad Hair, Entropy, and Roadside Physics (available at [www.joeandrade.org](http://www.joeandrade.org)).

She clearly caught the spirit of swow.

We started broadcasting with the first 8 finished programs in hand – 32 more to go! We finished 10 weeks later, just barely keeping ahead of the broadcast schedule. It was a tense and intense time.

Very early on, I realized that the students and I needed a textbook as well as the videos to enhance the course. I quickly modified the scripts and produced a textbook, which Simon and Schuster 'published' in 1998 – via their 'Custom Publishing' arm. It wasn't a 'real' book, but rather a custom published one. Interesting. Aaron did the design, layout, and produced the 'camera-ready' copy for Simon and Schuster. Neither the UU nor I worked hard enough to make it a 'real' book available for broad distribution. And it turned out to be more expensive for the students than if we'd simply photocopied the camera-ready master!

The course was offered and broadcast nearly every term, including summers, from Fall 1996 through Spring 2012 – some 18 years. It ended as I approached full retirement, and as The Leonardo opened. I arranged for a short 'reunion' of swow students at the newly opened The Leonardo on April 15, 2012, Leonardo da Vinci's birthday.

Pleased with the development of *Science without Walls*, Steve Kern and I planned and proposed a follow on course, focusing on Medicine and Physiology. We titled it 'Measurement and Medicine: Normal and Abnormal You!' Steve and I were soulmates in our interests in science education and critical thinking. We wrote several proposals in the late 90s to develop courses with which to

use personal physiology and medicine to teach critical thinking. But none were funded. The exercise did provide a strong foundation for work on the Utah Science Center and The Leonardo. It led to the Experiments on You! exhibit ideas and plans, many implemented later as The Leonardo and Low expanded.

The course philosophy and structure was presented as a Commentary paper in *The Scientist*, April, 1998. It noted our extensive use of heroes, music, and graphics.

I had obtained and distributed a dozen or so custom license plate holders printed 'Entropy Wins! Tues. 7 pm Chan 9' to get some exposure. I ran ads for students in the local student newspaper, including one copied after Daniel Quinn's ad in *Ishmael*: 'Teacher seeks Pupils'.

We submitted a final project report to the state HETI program in Sept. 1997. One of my conclusions was:

"...there has been little or no interest in making the course available to other institutions in Utah, in part, due to the apparent lack of a mechanism or incentive to facilitate such cooperation and sharing. The u of Utah administration has indicated little interest in making its courses available to other institutions. ...This is an issue which needs to be addressed by the Regents and by the Governor and his staff."

There was no response.

In 1999 Mary McDonald and I submitted a small proposal to the remnants of HETI to facilitate awareness of and distribution of the course. It was not funded.

## SWOW – What We Did and How We Did It

We contracted with the uu Media Solutions group in early 1996. They operated out of the Eccles Broadcast Center, the location for the uu's KUER and KUED public broadcasting stations. Kristy Campbell was assigned as producer/director of *Science Without Walls*. She had video and audio staff to shoot on

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location segments and a full studio to shoot the talking head portions of the script; Kristy's assistant was Tisha Heaton. We put together a production schedule. My major job was to produce the scripts and then perform them, under the guidance of Kristy and her team. I had a script advisor, Krista Rodin-Popich – and her assistants in Continuing Education. We worked to edit my scripts to be brief, crisp, and interesting.

A special, colorful stage set was constructed and used in the studio. I was advised to get some new clothes! Barb was excited and helped me select a set of shirts of solid, bright colors – as advised by Kristy, Krista, and their colleagues.

I began expanding my science background, acquiring all the then available videos relevant to the breadth and comprehensiveness of *Science without Walls*, including:

Blair, Lorne, and Lawrence. *The Ring of Fire – An Indonesian Odyssey*, 4 one hour programs, Mystic Fire Video, 1988, with a fifth called *Beyond the Ring of Fire*, in 1996.

Goodstein, David. *The Mechanical Universe... and Beyond*. 52 half-hour programs, Cal Tech, 1985.

Hoffmann, Roald. *The World of Chemistry*, 26 half hour programs, Annenberg/CPB Collection, 1989–1990.

Morrison, Philip, *The Ring of Truth*, 6 one hour episodes, PBS, 1987.

Sagan, Carl. *Cosmos – A Personal Journey*, 13 one hour episodes, Turner Home Entertainment, 1980–1989.

Sagan's *Cosmos* was a great influence and model. His commitment to public science literacy and critical thinking was the real foundation for *swow*.

We were behind schedule from the very beginning. Cliff Drew, the UU senior administrator responsible for continuing education and telecourses, threatened to stop and cancel the project unless I fully focused and began to deliver scripts.

I took leave from most of my other UU duties, thanks to the cooperation and tolerance of the Bioengineering faculty. I also resigned from The Leonardo Board in order to focus exclusively on *Science without Walls*. I buried myself in the reference videos and other materials. I used Enya and Madredeus as background music to aid in focus and stimulation. I finished a rough draft of the 40 scripts in April, 1996, then asked 17 friends and colleagues on campus to review and help me revise the scripts in their particular areas of expertise. I



needed serious help in some areas of physics and biology! Carlton Detar helped in Physics, Joe Dickinson in Biology (he seriously corrected and revised my distorted concepts of evolution!), Tony Ekdale in Geology, Herb Clemens in Math, Tom Richmond in Chemistry, and many others. The full list is at [joandrade.org](http://joandrade.org).

In 1996, as I wrote and revised the scripts, I suggested the video footage to accompany the various segments, including citing specific book images and video program segments. I personally acquired special video and audio materials related to Richard Feynman. Lynn Margulis' assistant, Lois Brynes, provided several videos and audio tapes of Margulis in action. Many others provided material and help, including the offices of Christian de Duve and EO Wilson.

I didn't know at the time that Carl Sagan had a terminal illness. I'd asked him to give us permission to use some segments of *Cosmos* in *swow*. On March 11, 1996 he responded in a letter with:

'I'm happy to grant permission for you to use for the telecourse in question, and for non-commercial use only, up to two to three minutes from my *Cosmos* television series...'

Three minutes is actually a lot of video. We very carefully selected and used segments from the entire *Cosmos* series. Sagan died in late December that same year. Thank you, Carl. In the same letter he advised me to look at his most recent book, *The Demon-Haunted World*.

My goal was to create the most video-intensive telecourse yet created in Utah. I also suggested special shoots of simple experiments, including many in our home and backyard at 6009 Highland Drive. With the kids now living away from home, I set up a science/video lab in one of their vacant bedrooms, with nearly everything on large media carts, so I could assemble and set up demos for the film crew. Many of my graduate students served as demonstrators and subjects in the shoots. Mindy touched a 9v battery's terminals to her tongue to demonstrate the discomfort of low voltage DC shocks! That second or two of video is great. She had a friend with a baby, named Elizabeth, to naturally 'pose' and act to illustrate our segments on babies as scientists, based on the work of Alison Gopnik.

Mary McDonald, Chiung-Sheng (Mr. Bear) Hsiung, Mara Lisonbee (now Hammer), Mindy Meservy, Mary McDonald (now Rogan), Joanna Zhang, Roshen Koshi, and Rob Scheer all appeared in specific video segments. Kirsten

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Kaczka, my then assistant and secretary, and Aaron Andrade were also major contributors. The filming was in 1995–6 by Media Solutions. The studio sessions were filmed in mid- to late-1996.

The course begins with the statement:

*Science without Walls* treats science as fully continuous and integrated. We do not dwell on the artificial boundaries which separate and segregate the common basic science disciplines: chemistry, physics, and biology. We also do not accept the common erroneous belief that science is something special or different from other fields of study. From the minute we emerged from the womb – observing and perceiving that new, strange, natural world around us – we have all been scientists. We have all been interacting with and trying to understand that natural world. That is science. The best scientists are those who are the least encumbered, who in many respects are the most naïve, the most curious, the most questioning.

The 40 videos and book chapters are organized as six units:

Unit 1: Science, Technology, Art

Unit 2: Physics: The Rules of the Game

Unit 3: Chemistry: The Stuff of the Universe

Unit 4: Biology: The Living World

Unit 5: Earth: Our Little Planet

Unit 6: Your World: Citizen Empowerment

Unit 1 – Science and Art was heavily influenced by Shlain’s *Art and Physics* – and his 1995 UU lecture. In it he quotes an art museum visitor, complaining while viewing a piece of modern art:

‘I’ve never seen anything like this!’

Shlain responds: ‘That’s the point!’

He refers to and acknowledges da Vinci and makes the case that artists really precede scientists in their perceptions of the Universe.

I also covered the UU cold fusion event and the problem of scientists treating their ideas and hypotheses non-objectively, irrationally.

The AAAS Project 2061 Basic Concepts and Themes were covered, laying the conceptual foundation for everything that followed.

The basic science disciplines (Units 2–4) begin with Physics First! – as recommended by the AAAS and Leon Lederman. Lederman was a Physics Nobelist and proponent of a Physics First curriculum. He taught physics to non-science majors at the U of Chicago, very unusual at the time. Physics first establishes the basic foundation of what we are pretty sure we know. Then I moved on to the stuff of the world (Chemistry), and Life itself (Biology).

Each basic science Unit begins In The Wild – no baggage, no encumbrances: Unencumber yourself. Pretend you are alone in the wild, trying to figure out the natural world around you. But in this fantasy, assume you are an adult, that you have language, that you can talk and vocalize, and you can express experiences and observations in words and write them down. You have your most essential scientific research tools – a pen and a notebook, because you know that your memory is often not very reliable. What do you see, hear, taste, smell, touch, feel? What do your fellow Scientists in the Wild see and feel?

We pretend to be Physicists in the Wild, then Chemists in the Wild, and then Biologists in the Wild. We discover science for ourselves – by direct observation. We rapidly ‘discover’ the key features and points of each of the basic sciences, preparing ourselves to observe and understand Planet Earth.

The segment titled Your Personal Periodic Table used Mr. ‘Bear’s’ hair and his thesis work on ICP-MS to directly demonstrate that  $\frac{2}{3}$  of the Periodic Table is in typical human hair. And that result we then connected to Carl Sagan’s ‘We are the stuff of stars.’

Wherever possible I connect to the student and his immediate environment – highways, food, bathrooms, kitchens, guns, hot-tubs, sports, ...

Units 5 and 6 are the heart and purpose of the videos, the book, and the course. Unit 5 – Earth, Our Little Planet, has two critical chapters. Is There Intelligent Life on Earth? – Chapter 36 – was stimulated by a Carl Sagan paper on observing Earth from space, without the aid of space probes or satellites. Fascinating what we can observe and learn. And Chapter 37 exposes us to James Lovelock’s prescient observations and ideas on Planetary Pathology and Planetary Medicine – the Gaia Model. This sets the stage for the final Unit 6 on Citizen Empowerment.

Chapter 36, *Your Stuff*, covers cars and transportation, building on George Carlin’s brilliant standup comedy skit titled *Stuff*. We learn of energy use, air pollution, solid waste, and general over-consumption and wastefulness.

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Chapters on Luck and Risk and then Health and Medicine follow. We cover Luck, Risk, and Choices – and very basic numerology and statistics. We cover debt, interest, basic financial literacy – and lotteries and gambling. We discuss two ill-defined four letter words: Need and Want.

Thanks to Mindy’s drawing and layout skills, we were pioneers in developing icons, memes, and messages – even some fake news ‘clippings’: *A Nation of Losers!* was one headline, informing us that nearly all lottery participants are Losers! We use guns and space shuttles to cover accidents and related risks – and risks we often voluntarily choose to accept: skydiving, skiing, rock climbing,...

In Chapter 39 – Your Creativity – I build on Feynman, da Vinci, and Rachel Carson, as well as Tom Stockham. It connects full circle back to Chapter 1 on Science and Art. John Gardner’s wonderful little book: *Excellence: Can We Be Equal and Excellent Too?*, 1984:

We need excellent physicists and excellent construction workers, excellent legislators and excellent first grade teachers. We need an approach to excellence and a conception of excellence that will bring a whole society to the peak of performance.

The final chapter, Citizen Empowerment, summarizes what we covered and what we left out – so much we had to leave out. It encourages the student to be interested, curious, involved – to vote, to run, to protest, to be active – to separate fact from fantasy – to be a garbage and bullshit detector, to speak up. And I conclude with some thoughts on tolerance and resilience, and a plea to simply get involved.

There are of course homework assignments, exams, projects, and experiments – as well as Heroes and Music – and a Labless Lab. My heroes are presented, especially in the final Chapter 40: Sagan, Feynman, Wilson, Margulis, Lovelock, Morrison, Carson, and da Vinci.

Each of the 40 segments ends with a piece of popular music relevant to the topic. Fortunately the UTU has a blanket license to use small segments of a wide range of music for its programs. I made special use of James Taylor’s *Secret O’ Life* at the beginning and end of the course.

I ‘taught’ the course from Fall 1996 to Spring 2012, as an offering of the Dept. of Bioengineering in the UTU’s continuing education – telecourse program. I gave talks on the course at other Utah colleges. The discussion at Snow

College in 2000 in Manti, Utah was especially interesting. They believe in ‘God’ there. Once I was referred to as Utah’s Carl Sagan. That was cool!

I did what I could to make the world aware, including purchasing a tape duplication system and making many copies of the vhs tapes for free distribution. A full set went to Prof. Sakurai in Tokyo for his activities in public science education, and one to YK Sung to use in Donguk University in Seoul, Korea. One went to someone in Chile or Argentina. It was shown in at least one Utah prison – in Gunnison.

My most comprehensive talk on science awareness, literacy, and education for the general public was given in Uppsala, Sweden in 2003 at the invitation of Karin Caldwell and her Department. I titled it: Science ‘Teaching’ – A 20 Year Perspective. It’s at [joeandrade.org](http://joeandrade.org).

Much more on the background, sources, and approaches are at [joeandrade.org](http://joeandrade.org) – the Science in Society tab – click on *Science without Walls*.

## Looking Back from Today

Working on this chapter in Sept., 2021, and pondering Sagan’s *Shadows of Forgotten Ancestors*, which I’d just finished reading, I realized that Carl Sagan published – in 1977! – *The Dragons of Eden: Speculations on the Evolution of Human Intelligence*. I was not aware of it – didn’t read it until 2021, while writing this book – nearly 30 years after Sagan’s early death.

Today I walked a new route across the utu campus to the Law Building foyer – a large, open, often largely vacant space where I do much of the writing for this Memoir. The path went just North of the old Biology Building, fortunately being remodeled rather than torn down. My mind did a half-century back-wander to the basement, where John Spikes’ Cobalt 60 radiation source was located. Nearly 50 years ago I was using that source, together with David Lentz and Hai Bang Lee, to do our first experiments on hydrogel grafting (bonding) to plastic surfaces – the focus of my first government grant, and the source of several of our earliest scientific publications.

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And now wandering back to today, 9-3-2021, Amalia Andrade's 15th birthday! – her *quinceanera*. Last year she started getting interested in chemistry and physics. Tonio suggested she might like to see some of the swow videos. So I set up a Joe Andrade *Science without Walls* YouTube channel. All 40 videos are there: YouTube Channel – *Science without Walls*: [https://www.youtube.com/channel/UCqC9Dh3ZoZc\\_X6s5K-rHg8g/videos](https://www.youtube.com/channel/UCqC9Dh3ZoZc_X6s5K-rHg8g/videos) (but without the James Taylor music due to copyright restrictions). The course textbook, designed and formatted by Aaron Andrade, is available on line for free at [www.joeandrade.org](http://www.joeandrade.org).

Sagan – and Druyan's – book (*Shadows of ...*) is excellent. It should be read by all high school freshman – and their parents and teachers. EO Wilson's *Consilience* should also be 'required' reading. Understanding our biological origins and histories provides a basis, a foundation, for a new 'evolution' of human behavior – towards a sustainable planet. And, of course, Sagan's last book – *The Demon-Haunted World: Science as a Candle in the Dark*, which he wrote with Ann Druyan – is so prescient and relevant to our times in 2021. He tried. And she is continuing to try, producing *Cosmos – 2, – 3, and now Cosmos – 4*, and posthumously publishing the very last Sagan book: *Billions and Billions*.

## Obrigado

I write these words on Nov. 30, 2021, in Casa Simpatica in Pacific Grove, CA, just a block from Monterey Bay. Sagan and Druyan's *Cosmos -1* began a few miles south of here, near the Big Sur coast, with Carl walking on a beach in front of magnificent surf. The introductory segment ends with him holding a dandelion, gently dispersing its seeds, and saying 'Come with me'...on his personal journey of the *Cosmos*. Brilliant! Thank you Carl and Ann.

And thank you Governor Leavit and the uu. swow was my own personal journey. I hope it made a worthwhile contribution to critical thinking and a responsible citizenry. One can indeed hope!

Onward...

# **The Leonardo – 1986–2022**

*The Leonardo, the Utah Science Center, Hansen Planetarium • Hansen Planetarium, Stephen Hawking, and Diane Beam • Science-Arts, FFKR, USCA • Planetarium in Transition • From Horton and Sci-Tech to Utah Science Center • New Library, Old Library Building, Salt Lake City • The Leonardo via Three Partners? • Initial Fundraising • A 'Renaissance' Bond • Flight! – 2005 • Just in Case! – SLVSEF, LOW, Exhibits • Leonardo's Laptop – Fundraising • Fundraising and Jim Sorenson • A real The Leonardo • BodyWorlds – 2008 • STEMWorks – 2008–9 • The Leo, LOW, and SLVSEF • Connections, Patterns, the Digital Leo • LOW, SLVSEF, and Sustainable Futures • Giles, Merger, No NDA, Opening • Dennis Evans • Opening to Operation • The da Vinci Award • Science Centres on the Road – Places, People, Perspectives • Plans and Ideas – so far Unused • Risk, Statistics, Numbers – and Paul Slovic • MDD – Motion Deficit Disorder – You! are the Exhibit • Nearly Last Thoughts*

## The Leonardo, the Utah Science Center, Hansen Planetarium

THE LEONARDO BEGAN, for me, on Oct. 7, 1993. I was sitting next to Bob Olpin, who had a copy of his Concept Doodles document, titled THE Leonardo. He also had a copy of a recent book titled *Art and Physics*, 1991, by a Leonard Shlain, M.D. Bob and I were on a committee appointed and called by Ray Kingston, the 'K' in FFKR Architects. Assembled in FFKR's conference room in their downtown offices, we learned that FFKR had just been awarded a contract by the State of Utah for a planning study for a science-arts center.

The State of Utah now 'owned' the old Union Pacific Depot just west of downtown Salt Lake City. It was largely vacant, although it was housing the state art collection. The building needed to be used for something which would further enhance the state and the community. Ray and Bob, who was the UU Dean of Fine Arts (he served as Dean from 1987–1997), were connected to the arts and humanities community and had already been discussing the possibility of a science-arts center. The 'science' part was likely catalyzed by the Hansen Planetarium's interest in expanding to become a full-fledged science center. The state was into technology and entrepreneurship, so a 'science' center seemed like a good idea to many people. Salt Lake County was also very supportive.

My own 'general' education and science 'literacy' interests were prompted by the 1983 *A Nation at Risk* Federal report. These interests led me to Delmont Oswald, Director of the Utah Humanities Council as well as to Ray Kingston, who had set up a Utah Alliance for Arts and Humanities Education in 1992.

Shlain's *Art and Physics* was a remarkable, prescient book and set the stage for my study of Leonardo da Vinci and the 30 year effort to plan and develop a truly unique facility for creativity, education, and connection. But well before Shlain's book I had a fascination for Flight and for da Vinci. Barb's gift to me of a beautiful book called *Flight* for Christmas, 1965, had some sketches and quotes by Leonardo. We still have it. My interests in Chuck Yeager, the sound barrier,



my Dad's flying the Yellow Peril in Centerville – and giving me rides! – all that contributed to a fascination with and commitment to Flight. So The Leonardo, for me, was perfect.

During the late 80's, Von Del Chamberlain, the Hansen Planetarium's then new Director, had tasked its Board with studying the possibility of a science center, building on the strength and prominence of the Hansen Planetarium. Von Del was encouraging his staff and Board to think and plan for the Planetarium's expansion and future via becoming a new generation science center. His efforts and perspectives are well covered in his 2006 memoir *Voyaging Among Stars* (pp. 174–221). A copy of those pages are posted at [www.joeandrade.org](http://www.joeandrade.org). The full memoir is in the UTU Marriott Library. Von Del asked me to serve on his Advisory Board. I enthusiastically accepted and immediately began studying and visiting science centers whenever and wherever I traveled.

The Exploratorium (San Francisco) and the Ontario Science Centre (Toronto) had opened in 1969, the first of a new generation of 'hands-on', interactive science centers. They served as a catalyst and models for many such centres around the world.

I was fortunate to be able to travel in the 90's, largely thanks to serving on the Scientific Advisory Panel of Smith & Nephew, a United Kingdom-based medical products company. Meetings were held twice a year, usually somewhere in England or Wales. Traveling to and from London provided the opportunity to travel within Europe. My Korea travels provided excursions to museums and science centers in South Korea. And an invited workshop on 'Intelligent' Polymers in Wollongong, Australia (South of Sydney) provided access to science centres in Wollongong, Canberra, and Sydney – as well as on New Zealand's North Island: Auckland, Hamilton, Palmerston, and Wellington.

For the next 20 or so years my travels included visits to science centres, discussions with their people, participation at their conferences, and in using that information and experience to help plan The Leonardo. I joined ASTC (the Association of Science and Technology Centers), based in the U.S., and ECSITE (the European Network of Science Centres and Museums). The travels and visits included science centers and natural history museums in nearly all cities I visited over about 40 years, including:

San Francisco (Exploratorium), Portland (OMSI), Seattle (Pacific), Denver, Boise, St. Louis, Milwaukee, Chicago, Cleveland, Columbus (COSI),

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Indianapolis, Boston, New York City (Hall of Science), Durham, Miami, Seoul, Daejung, Yokosuka, Honolulu, Los Angeles, Oakland, Berkeley, San Jose (TheTech), Phoenix, Albuquerque. Birmingham, Philadelphia (Franklin Inst.), Cincinnati, Newark (Liberty), Toronto (Ontario), Sudbury (Science North), Vancouver (Science World), Washington DC (Koshland – NAS), Baltimore, Munich, Barcelona, Amsterdam, Belgium (Mechelen), Finland (Vantaa), Stockholm, Copenhagen (Experimentarium), Milan, Florence, Vinci, Paris (La Villette and Palais de la Découverte), Amboise, Glasgow, Bristol (Exploratory), Manchester, London, Cardiff (Techniquet), Sydney (PowerHouse), Canberra (Questacon), Auckland. There were special trips to specific science centers, including Liberty in NJ, the Science Museum of Minnesota (SMM) in St. Paul, and Science North (Sudbury, Canada).

The interest in science centers provided me with a reason to embrace technical and consulting travels and interests with the broader societal interest in science education. Some of those visits and the wonderful people I met are presented at the end of this chapter.

## Hansen Planetarium, Stephen Hawking, and Diane Beam

Salt Lake County, who owned and operated the Hansen Planetarium (and still does), had commissioned an earlier study in 1986 for an expanded Planetarium – Science Center. The donation of the Union Pacific Depot to the state of Utah in 1989 expanded interest in a science center and arts facility. There was also interest in commercial development of the area adjacent to the Depot. The area was dubbed the Gateway Center. Salt Lake County found some funds and engaged a consultant group in 1991-92, ERA Associates, to begin studying the feasibility of a state science and arts center. ERA engaged Taizo Miake, one of the key people behind the Ontario Science Centre in Toronto – and later Science North, the Sudbury Science Centre – to assist. Taizo and Ray

really connected and bonded. Taizo's enthusiasm and ideas were infectious and inspiring.

The Planetarium, via its creative and dynamic Diane Beam, had made contact with the British physicist – cosmologist Stephen Hawking (the author of the hugely popular *A Brief History of Time*), who agreed to help author a new Hansen Planetarium show: Fate of the Universe, including a visit and presence in Salt Lake City! Hawking developed a real fondness for Diane, whose infectious enthusiasm helped move the project and collaboration. Diane received an undergraduate Physics degree from BYU and wanted to learn all she could about the origin and 'fate' of the Universe. She wrote and produced Planetarium shows.

In early 1993 the Utah State Senate passed Senate Bill SB 90, introduced by Senator Ron Ockey, to establish a Utah Science Center Authority (USCA), with an appropriation for an initial feasibility and planning study, and included architectural services. The newly installed Governor, Mike Leavitt, did not sign the bill but allowed it to become law. He had been asked to veto it by the local traditional museum community, especially the director of the Utah Museum of Fine Arts (UMFA), Frank Sanguinetti, who said:

'We already have plenty of more-than-adequate institutions inadequately funded. They barely subsist. The idea of a science center is horrifying considering how much more money it could take.'

Sanguinetti was working to fund and build a new Museum of Fine Arts on the UTU campus. It opened in the new Price Building in 2001.

Leavitt was a fan of new technologies; he appointed Dr. Suzanne Winters, from the bio-med tech sector, as his new science advisor. Suzanne was a former PhD student of mine (Ph.D. Pharmaceuticals, 1986). She had already been part of the discussions relating to a Utah Science Center (maybe a science-arts center!) with the Hansen Planetarium as its nucleus.

In May, 1993 the Utah Centennial Commission designated the Science-Arts Center as a State Centennial Project. Governor Leavitt appointed the new USCA Board in June, 1993, and included me and Suzanne Winters among its members.

When Joe Cannon, the President/CEO of Geneva Steel, heard on the radio that the Planetarium needed help to fund the Hawking visit and lecture, he immediately called the Planetarium and gave \$10,000. I learned some years later

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that Joe Cannon was very well read and a student of cosmology and of the origin of the Universe.

The Planetarium hosted Stephen Hawking on July 3, 1993 for a free public talk in Salt Lake's magnificent Abravanel Hall, the home of the Utah Symphony. We had arranged to rope off the major part of the seating, to encourage attendees to sit close to the front, so Hawking wouldn't feel too far away from the expected small audience. It was Fourth of July weekend, and we were concerned about the size of the audience.

When I got there about an hour before the talk, there was a line of Hawking fans surrounding the entire city block, several times over! It was incredible. Literally thousands of people lined up to hear Stephen Hawking. Some were costumed. The entire *Star Wars*, *Star Trek* crowd was lined up. Some 7,000 people had to be turned away due to lack of seating, although some of them heard the talk via standing in the foyer. The event highlighted plans for a Utah Science Center, including a supportive statement by Hawking. This was a key event – it showed that there is a large, local community interest in substantive science activities and events.

On July 4–5, 1993 the Hawking-Beam Fate of the Universe program premiered at the Hansen Planetarium.

Some years later, Joe Bauman, the *Deseret News* science reporter, wrote:

'Hawking has displayed real verve, energy, wit. Doug Lowe of the planetarium said he has been running the staff ragged. As soon as he arrived yesterday, he had them take him out to the Great Salt Lake, saying he wanted to see it since he was 12. Then he took the staff to a late show of *Jurassic Park* at Trolley Square. Then at 1 a.m. he was still up for more.'

I met Hawking very briefly at a dinner that evening, which ended early so he could see the just released film *Jurassic Park!* He was, of course, limp in his instrumented, computer-equipped, wheel-chair, 'speaking' brief, carefully typed short phrases via his synthesizer. I vividly recall his eyes – they were so powerful – almost literally on fire, resembling a wolf's eyes – intense, penetrating, fearless – and intensely curious.

## Science-Arts, FFKR, USCA

The State's Division of Facilities Construction and Management (DFCM) issued an RFP and then selected the FFKR group to develop preliminary plans for the Utah Science and Fine Arts Center in and around the Union Pacific Depot. Ray Kingston was appointed project director by FFKR. Ray's already strong connection with the arts and humanities community facilitated strong interaction among all groups and interests. Bob Olpin's – and Ray's – ideas for a Leonardo-themed project came out of those initial discussions – which is why I was sitting next to Bob Olpin and his Leonardo Doodles in Oct., 1993!

As far as the State was concerned, we were to develop a Utah Science Center in the Union Pacific Depot, which also housed the State Art Collection managed by the Utah Arts Council. Ray's connection with the Arts and Humanities community led to a Science-Arts Center focus. But Ray's Humanities interests, coupled with Olpin's suggestion, and Taizo Miake's interest, led us to call the project The Leonardo. The two names were sometimes used interchangeably: The Leonardo (The Leo) and the Utah Science Center (USC).

The USCA Board began meeting in the Salt Lake County office complex in late 1993. The County had found some resources to host the USCA planning effort. Marlin Berrett was appointed Board Chair. Ron Ockey, the Senator who authored the state enabling legislation, was appointed as CEO, with Carol Clark as Executive Director. The three, and the Board, were charged with raising the money for the project. A number of us were disappointed with the selection and appointment of Ockey and Clark.

The Board also served as a Utah Science-Arts Center taskforce, and organized itself with various committees and advisors, eventually including 100 or so people from the University, public education, arts, sciences, business, and related communities. Jake Garn, who was just finishing his term as US Senator, agreed to chair a Development Committee to begin fundraising. A Committee chaired by Sid Green, with the firm TerraTek, focused on the opportunity to include an IMAX 3-D projection system in the facility. Richard Erdmann chaired an Education Committee.

I chaired a large Program Committee, which came up with concepts, themes, ideas. We studied the newly opened Liberty Science Center in New

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Jersey, as well as the more established centers. Diane Beam and Mark Palmer of the Hansen Planetarium staff were especially creative and involved. We had colleagues and friends from a range of disciplines and with diverse expertise. We all participated in dynamic, exciting, educational discussions.

I recall once when Paul Cox, a BYU Professor of Biology-Botany, came dashing into a meeting of the Program Committee, running late, with enthusiasm, vigor, and excitement colorfully evident. He had just landed, returning from Borneo or New Guinea. He is an ethnobotanist and is always scouting for and studying fascinating plants with medicinal and therapeutic potentials. He had been a Mormon missionary in Samoa, and now runs a not for profit on land issues in Pacific Island nations (Seacology). I asked him how he could be so exuberant and alive, after having just flown half-way around the planet. He confided that he had observed and been experiencing a new medicinal plant. He was a 'good' Mormon, so certainly didn't drink anything, including coffee! But interesting plants were not a problem. A fascinating fellow.

Rod Millar was a local engineer, artist, and mathematics teacher who was working at the time with a state energy office, with resources to fund small grants. Bob Johnson was Chair of the uu Dept. of Computer Science. I was involved with hiring Bob while serving as uu Dean of Engineering. They were on our Program Committee and immediately became close friends.

In Dec., 1993 FFKR received the actual Notice to Proceed from the State DFCM. His group included:

Taizo Miake, as special Programming, Exhibition, and Visualization Consultant, Sudbury, Ontario, Canada;

Ed Francis – William Kessler & Associates, Architects, Detroit, Michigan;

Hawkins Stern – Economics Research Associates, McLean, Virginia;

Thayne Robson, Director – Bureau of Economic and Business Research, uu.

The usCA Board-Taskforce also included an Architectural Programming Committee:

M. Ray Kingston FAIA, – Project Director – Programming, Planning, & Design;

Joseph Andrade, Bioengineering, University of Utah, usCA Board;

Rod Millar, Manager, Technology Demo Programs, Utah Energy Office, DCED;

Von Del Chamberlain, Director, Hansen Planetarium, usca Board; Robert S. Olpin, Dean, College of Fine Arts, u of u, Vice Chair, Utah Arts Council; Robert Johnson, Computer Science Department, Univ. of Utah, usca Board; Sheri Barton Trbovich, Associate Director of Programs, Hansen Planetarium; Bonnie H Stephens, Director, Utah Arts Council; Aden Ross, Playwright, Member, Utah Arts Council Board.

In March, 1994, Rod Millar developed and presented a Meeting of Minds project, including contacting the concept's originator, Steve Allen, who agreed to participate. Working with the Utah Arts Council, local writer/playwrite Aden Ross indicated interest in developing the scripts.

SL County approved \$150,000 for the project and provided office space in the SL County office complex. Also in 1994 Senator Ron Ockey submitted SB 277 to launch the proposed Leonardo on Wheels (LOW) mobile science center – to provide informal interactive hands-on science education throughout the state. An \$185,000 appropriation was included in the bill and authorized in the last few minutes of the session! But the funds never materialized.

In Spring, 1994 we held a Utah Science Center (usc) planning and organizational retreat at Homestead Resort – with Jake Garn and consultant Jim Backstrom. The group discussed the vision of a Utah Science Center, including futuristic McNeil-Lehrer Newshour 'scenarios' from opening!

In mid-1994 Rod Millar, working with Bob Johnson, organized and presented a Leonardo-esque demonstration of activities for the County Commissioners, the Utah Arts Council, the usca Board, legislators, and others to show what a TheLeonardo facility might entail. It was a remarkable day with state of the art microscopy, electronic music, mechanics, graphic arts, ...Millar, Johnson, and I had great fun brainstorming and envisioning exhibits, activities, programs for The Leonardo – and involving our students, friends, colleagues to join us. Participants also included Thomas Beebe (uu, Chemistry) and Tracy Petersen (uu, Music).

Also during 1994 Diane Beam and her crew filmed Hawking in England. Hawking footage was collected in anticipation of a documentary film version of the *Fate of the Universe* show.

The FFKR report was a beautiful, artistic, small banner-like poster – submitted to the state DFCM in late 1994, together with a large physical model of the

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Gateway Center project. The rough estimate was \$50 million, a mighty sum for the state of Utah. Ray Kingston had talked with Union Pacific about land issues, track siting, and many other issues, with some success. But it was becoming clear to some of us that the project was unlikely to be feasible.

The report noted the overall theme of ORIGINS, with the general philosophy The Science of Art /the Art of Science. Topical areas were:

MacroWorlds

Earth and Biosphere

You! the Visitor

MicroWorlds

We continued to develop awareness of the project via various events and activities.

A Univ. of Utah Student Union ArtScience exhibit was coordinated by Mary McDonald.

The Center for Integrated Science Education recruited students to design/develop interactive exhibits under supervision of J Andrade. uu Architecture students presented their models and entries in a design contest for the Gateway Center.

1995 marked Hansen Planetarium's 30th anniversary, together with the hosting of a second Stephen Hawking visit – a ticketed event at the uu Huntsman Special Events Center.

Hawking lectured to a full house of 12,000 on July 17, 1995, using the title: 'Does God throw dice where they cannot be seen?'

Hawking, Beam, and the team then traveled to Southern Utah to film Hawking in Utah – footage for the planned *Fate of the Universe* video documentary.

In Oct. 1995 Ron Ockey was formerly appointed CEO of the Science-Arts Gateway Center project. He suggests the site and Center as a venue for the 2002 Winter Olympics.

A major gift of \$100,000 secured from the Ashton Family Foundation was directed to LOW development and implementation. That gift was likely orchestrated by Carole Clark, Marlon Berrett, or Ron Ockey. Sandra Zicus was hired to implement and direct the program; additional staff and volunteers included Andy White, James Biggs, Mary McDonald, and Clint Eliason. The initial LOW shop and lab was at uu Research Park in space assigned to the Center



for Integrated Science Education (CISE), which I administered, with the aid of Mary McDonald.

But I now had a major commitment and need to focus on the new UU television course – *Science without Walls* (swow), funded by the new HETI initiative from the Leavitt administration. It included much of the vision and philosophy of The Leonardo. swow was already very behind schedule, so I requested leave from the science-arts center/Gateway Project. For the next two years my involvement was kept to a minimum.

The USCA launched the Leonardo on Wheels traveling science center at the Utah Arts Festival in mid-1995 at the Delta Center. There was considerable interest and encouragement of the project. Clint Eliason was appointed Director of LOW a year later when Sandy Zicus relocated to a position in New England, as I recall.

## Planetarium in Transition

About this time, Mike Clark, son of UU alumnus Jim Clark (of Netscape fame and fortune) set up the Clark Foundation ([www.clarkfoundation.org](http://www.clarkfoundation.org)) to fund various informal science education programs, including HP and Leonardo on Wheels.

SL County Commissioner Brent Overson (especially his aide, Julie Peck) became responsible for the Hansen Planetarium – which was an agency of and partially funded by SL County. There was interest in getting the new Clark Foundation to fund a new and expanded Planetarium at the Gateway Center.

The USCA Board had organized to plan a science center assuming the Hansen Planetarium as its nucleus. We didn't realize at the time that the County was moving to semi-privatize the Hansen Planetarium and to greatly diminishing its county appropriation. At the time friction developed between SL County 'micro'-management of the Hansen Planetarium and its Director, Von Del Chamberlain. This is well noted in the Chamberlain memoir. Von Del objected to the county's plans, so much so that he was encouraged to retire. He did so in May, 1996, reluctantly, and relocated to Kanab, Utah.

## Obrigado Pela Vida

Salt Lake City and County were clearly interested in the Gateway area going commercial – as well as becoming the home for The Childrens’ Museum of Utah and perhaps the Hansen Planetarium. The Gateway Center study catalyzed the re-shaping of the City blocks extending from North Temple, south to 400 South, and from 400 West to 600 West. It also was the catalyst for the re-configuration and shortening of the 400 South and North Temple viaducts, and the re-routing and removal of abandoned rail tracks.

SL County then requested proposals to manage (‘privatize’) the HP. The new contract was awarded to the Utah Museum of Natural History (UMNH). Several USC/USCA participants, me included, felt that UMNH would work with HP staff to develop a true Utah science center. Thus the USC/USCA initiative began to wane. Continued County micro-management and the entrenched UMNH and HP ‘cultures’ didn’t help. Perhaps even more importantly was the County Council’s interests in facilitating the development of the Gateway Mall and shopping district.

By early 1998 it became very clear that the USCA/TheLeonardo facility at Gateway – or elsewhere – was going nowhere. The USCA Board then resigned en masse due to the lack of a suitable site and lack of progress. It was a vote of No Confidence in the management and direction of the project.

The USCA Board resignation basically ended the FFR Gateway Center plan and location, but not the USC project. Many of us continued talking and planning, committed to a Utah Science Center and perhaps its later development into a TheLeonardo.

But we now had a new problem. We had a somewhat successful and funded LOW mobile outreach effort with no home base or formal oversight. LOW was still ‘housed’ in ‘my’ CISE space in the Research Park. Suzanne and I met for lunch to discuss this issue. Accompanying her was a new face on a tall frame – named Winter Horton. We met, talked, planned – even plotted.

Suzanne worked with Gov. Leavitt to appoint a four person USCA mini-Board (Joe Andrade, Suzanne Winters, Winter Horton, and Lynn Blake) to oversee ongoing Leonardo on Wheels activities. Dr. Lynn Blake was the Director of the State of Utah Centers of Excellence program, which was established during the prior Bangeter administration. The new mini-Board met regularly to oversee LOW and continued to search for a suitable location for a Utah Science Center.

## From Horton and Sci-Tech to Utah Science Center

A key aide to Utah Senator Robert Bennett, Winter Horton had just relocated to Salt Lake City to run Bennett's local office. He was serving as Bennett's communication director and was active in public television projects. He was a fan of science centers, although not so much of science-art or Leonardo-'flavor' projects. Shortly after arriving in Utah, Winter contacted Leavitt's office, was directed to and met Suzanne, and became aware of the Utah Science Center project and of its Leonardo on Wheels initial implementation. LOW was designed and built along the lines of the San Francisco Exploratorium – single-concept hands-on interactive exhibits, which greatly appealed to Horton.

This is why Horton was appointed to the new USCA mini-Board. I was back in the loop because SWOW was complete, on air, and running smoothly. For the next several years Winter Horton kept the dream of a USC alive, searching for sites, and involving local leaders. Sites considered included the State Fair Park and the EIMCO Building, among others.

Clint Eliason, now directing LOW, was connected to Utah State University (USU) and its Discovery Alliance outreach efforts. Clint got USU to take an interest in LOW, resulting in LOW moving to Logan, co-sponsored by USU's Discovery Alliance, now a part of USU Extension Services. LOW's name was soon changed to Discovery on Wheels (DOW) and targeted more towards lower elementary science experiences. Clint Eliason served as its Director until 2003; David Francis then became Director. The USCA mini-Board provided minimal formal oversight and some limited funding.

Winter was a real doer and political connector. Using his clout as a Bennett aide, he contacted and involved the Eccles Foundation to provide some seed money for planning. Salt Lake City Mayor Rocky Anderson (who took office in January, 2000), Jake Garn, and others were assembled by Horton and asked to develop a plan for a Salt Lake City science center. We looked at several possible sites to no avail.

## Obrigado Pela Vida

The George S. and Dolores Dore Eccles Foundation granted \$10,000 to USCA for a feasibility study. Sci-Tech was adopted as the name of the project. Winter Horton assembled a new advisory group and hosted discussions between them, Jake Garn, and Rocky Anderson.

The Utah Museum of Natural History (UMNH) had moved forward with its new facility above the UTU Research Park, thanks to significant funding from Rio Tinto (formerly Kennecott Copper). Although UMNH managed the Hansen Planetarium for one year, the County chose to develop its own independent facility in the Gateway Center.

The old library building and the magnificent new SLC Public Library were at two corners of a large full city block now known as Library Square, with a large central plaza and fountain suitable for large outdoor events. The restored castle-like SLC office building anchored Washington Square, a full city block to the immediate west of Library Square. The two adjacent blocks provided a very large space for large outdoor events, such as the Salt Lake Arts Festival and the Living Traditions Festival.

# New Library, Old Library Building, Salt Lake City

The Salt Lake City Public Library (SLCPL) moved to its dramatic, new building a half-block away in 2005, thanks to a major bond passed in 1998. The new library was an instant architectural icon and success. Shepherded by the Library's Director, Nancy Tessman, who insisted on excellence and uniqueness, the Library Board had appointed Moshie Safdie as the lead architect, working with VCBO, a local firm.

There was great interest in the future use of the old library building. In early 2000 Mayor Anderson's office issued a request for proposals (RFP) for occupancy and use of the soon to-be-vacated library building. We talked with SL County about possibly including the Hansen Planetarium in a proposal, but they declined and went forward with a major bond for a new Planetarium in

the Gateway area; that bond was passed. The Hansen Planetarium was subsumed into a new Clark Planetarium, and opened in 2003 in a new facility in the Gateway Center (almost adjacent to a new The Children’s Museum of Utah – TCMU).

In early 2000, thanks to that small Eccles grant secured by Horton, we asked Clint Eliason to draft a major proposal for a Utah Science Center in response to the City RFP. We used the proposal to attract community and philanthropic interest and support – and to formerly respond to the RFP. We called it SciTech: the new Utah Science Center @ Library Square. Several other groups also submitted proposals for occupancy and use of the (old) Main Library Building. Thanks to Winter’s urging and ‘pushing’, Mayor Rocky committed space in the building for the Utah Science Center, as well as to other community groups, to be specified.

The SE corner of Library Square in 2004 became the site of A Gift of Life/Celebration of Life, a monument recognizing organ donors. The project was organized and implemented by Lisa Hawthorne, a dynamic, avid organ donor celebrant. Jake Garn, a kidney donor in 1986, helped support the project and its installation. We had many discussions on potential The Leonardo (The Leo, for short) content related to organ donation, transplantation, and immunology.

The initial commitment of space, via the library RFP competition, reinvigorated our small group. We asked Rep. Lamont Tyler (my UU colleague in Chemical Engineering) to sponsor House Bill 77 in the 2001 Legislature to revise and re-empower the USCA Board and to provide seed funding. The bill passed conditional on a successful lease agreement with the City:

H.B. 77 State Science Center (A. L. Tyler)

This act reduces the size of the Utah Science Center Authority’s board from 17 to 13 members and clarifies that the scope of the authority includes the promotion of technology and engineering. The science center is required to have an extensive collaboration and outreach program that serves all regions of the state. The act repeals the Utah Science Center Authority’s power to issue bonds. The act appropriates \$225,000, non-lapsing, from the General Fund for fiscal year 2001–02, to the Utah Science Center Authority for the development of a state science center.

## Obrigado Pela Vida

The appropriation is conditioned on the center securing a contract of at least 30 years for the site. This act takes effect on July 1, 2001.

The George S. and Dolores Dore Eccles Foundation provided an additional \$25,000, half to continue the feasibility and planning study and the other half to help support the Discovery on Wheels outreach program.

After considerable discussion, in May, 2001 we changed the project's name again – from SciTech to Utah Science Center. A [www.utahsciencecenter.org](http://www.utahsciencecenter.org) website was established with Xmission in Salt Lake City.

In May, 2001 Mayor Anderson publicly announced the old Library Building will be used by the Center for Documentary Arts, the City's Global Artways program, and the Utah Science Center, and charged the three 'partners' to develop a civic and community center with which to enrich the City and enhance Library Square. Banners were placed on the building, stating "New Home of Utah Science Center, ...." The three partners signed a Memo of Understanding with VCBO architects for largely pro-bono services for the design and planning of the joint use of the old library building. They later signed an 'Authorization to Proceed' with the schematic design phase of what we called The Leonardo Center. VCBO offered pro bono services; they were very familiar with Library Square, having designed the new City Library and parking structure.

We formed the Utah Science Center Foundation in August, 2001 (State Registration # 49623400-0140); the Board was Horton, Winters, and Andrade. We applied for 501c3 IRS status. We penned a lease with the City. The revised USCA Board was formed at that time and began meeting and planning. The significant seed funding authorized in HB 77 did not materialize due to state budgetary problems. So the USCA was charged with developing and opening a Utah Science Center in a Salt Lake City-owned building, with essentially no funding.

The Utah Science Center Foundation (USCF), a private 501c3 tax exempt organization, was established to plan, implement, operate, and maintain the Utah Science Center. The USCA Board functioned as a State Advisory Board or Council to USCF in the development of the Utah Science Center. During the discussions in early 2001 which led to HB 77 in the 2001 Legislature, the then Quasi-Governmental Entities Committee made it clear that the State preferred to not operate or run organizations such as a Utah Science Center. Rather the

function of the USCA was to facilitate the development and implementation of a science center, but that its operation and ongoing support should be via a private, not for profit, non-governmental entity – hence the formation and operation of the USCF.

The first meeting of the new USCA Board was in Sept. 2001. I was elected Board Chair; S Winters, Vice-Chair; and J Brinton, Treasurer – we three constituted the Executive Committee. In October the Utah Science Center Foundation received a Charitable Organization Permit from Utah Division of Consumer Protection: #C2901

We signed a 30 year lease with the City in Oct. 2001, and secured design and graphic services from CogBox, a new, very creative firm we found via one of Horton's friends.

Mary McDonald worked with me to set up a Science in Society panel discussion series, launched in Oct. 2001. The series was cosponsored by the Salt Lake City Public Library (SLCPL) and KCPW Public Radio, which broadcast the evening discussion. The Science in Society initiators were Mary McDonald and Katie Mullaly. Chip Ward, then Asst. Director of the SLCPL, played a significant role in initial planning. The first discussion (Oct., 2001) was Energy, the United States, and the Planet, followed in Jan. 2002 with Blood, Sweat, and Tears: Has Olympic Drug Testing Gone too Far? – just ahead of the 2002 Winter Olympics in Salt Lake City. The Science in Society public dialogues continued through 11–20–2008.

Mary Tull and I began to talk probably in 2000 or so. I recall we were introduced by Mary McDonald, who was working with me at UU on CISE. It was Tull who likely introduced me to Hugh Bollinger at about the same time. Mary Tull went on to play a major role in the development of The Leonardo. Hugh Bollinger became a consultant and close friend – to this very day.

In November, 2001 USCA finalized its thirty year lease (via an Inter-Agency Agreement) with Salt Lake City for major space in the Library Building. The next month USCF received IRS 501c3 (not for profit) status (EIN 87–0685104).

The Plan for the Utah Science Center was completed and made available, as well as a widely distributed two page summary document. The CogBox group designed and delivered a very creative awareness poster/brochure on the Utah Science Center: the mind is like a parachute: it only functions when open. It also contained daVinci-esque images and diagrams.

## Obrigado Pela Vida

Salt Lake County appropriated \$15,000 for a fund raising feasibility study. USCA engaged Pathway Associates to do the study, under the direction of David Jones.

# The Leonardo via Three Partners?

The three partners and the City almost immediately realized that their goal and vision could best be achieved through a unique, ‘umbrella’ entity to manage the building, coordinate activities and programs, and to build on the partners’ individual strengths and missions to provide a whole greater than the sum of its parts.

Thus on January 10, 2002: The Library Square Foundation for Art, Culture, and Science (alias The Leonardo Foundation) was established to serve as an ‘umbrella’ group to manage and operate the Library Building for the benefit of the three partners: Utah Science Center (USCA), Center for Documentary Arts (CDA), and Global Artways. The Library Square Foundation Articles of Incorporation were completed and filed with the State of Utah; the initial Board consisted of 5 members:

J Andrade, Chair, USCA

L Kelen, Secretary, CDA

E Harding, Vice-Chair, Global Artways

N Tessman, Director, City Library

DJ Baxter, Member, Salt Lake City Mayor’s Office

A request for IRS 501c3 status was drafted and submitted.

After considerable discussion, the partners elected to name the facility and project The Leonardo, recalling Robert Olpin’s Leonardo Doodles of Oct. 1993. Thus The Leonardo at Library Square was formally born. In March 2002 VCBO submitted its building remodeling/refurbishments estimate – about \$10 million for seismic, utilities, and needed remodeling. In March the Legislature appropriated \$49,000 to partially replace the \$225,000 appropriated by the



previous Legislature but later rescinded due to a State funding exigency; the bulk of the \$49,000 was directed to the Discovery on Wheels traveling science center. In April Xmission became a formal sponsor of the Utah Science Center/The Leonardo, providing pro bono web and email services.

In May David Jones presented the Utah Science Center Fund Raising Feasibility Study report to Salt Lake County Council, recommending a capital campaign of up to \$18 Million over 18 months (the USCA Board received the report at its meeting on May 21 and empowered the Executive Committee to move forward to implement the recommendations made in the Jones report).

In 2002 I was doing all I could to meet and network with the business and entrepreneurial communities. One mechanism was a monthly Technology@Breakfast, sponsored by the Utah Technology Alliance as a meet, greet, and eat with a speaker – with time to network. I attended as many as I could. At one in late Dec. 2002 I presented on The Leonardo – Utah Science Center. There I met Phillippe Wyffels and Jeff Unruh. Jeff came from the tech venture sector and had interests in science education and science centers. Phillippe was more on the finance/numbers side and looking for opportunities. They each became involved with The Leo/USC, initially as volunteers. Phillippe was one of the first senior hires by USC, probably initially part-time, likely in early 2003. Phillippe grew up in Belgium, had worked in Brazil, and had a Brazilian wife. We talked a bit via my horrible Portuguese.

Laurie Downing produced, in 2002, The Leonardo initial logo using a Mona Lisa theme, as well as brochures and banners, including several which we had hung on the exterior of the old library building, now becoming known as The Leonardo.

Thanks to the clout and actions of Winter Horton, and the skills of David Jones, The Leonardo Capital Campaign Leadership Committee, chaired by Jake Garn and David Gardner, suggested a public/private partnership, using a bond or related mechanism. After *A Nation at Risk* and the Presidency of the Univ. of Utah, Gardner went on to serve as President of the UC-California System, then later retired to Park City, where he was now residing.

The Leonardo then contracted with Pathway Associates for fund raising consulting services. Les Kelen suggested the group consider a City bond initiative for the remodeling of the old library building. He'd had some encouragement via a CDA Board member who also served as a City Councilman.

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In Dec. 2002 David Coccimiglio, a UU student, designed and conducted a Leonardo Parachute Contest at Cottonwood High School. He also submitted a report related to other Leonardo-based activities for The Leonardo. He later made a personal trip to Italy, visited Vinci, and talked with the director of one of their museums about our plans for The Leonardo.

From late 2002 into 2003 Diane Beam worked with usc to develop short video scripts and plans, called Leonardo in Time, for possible airing on local television. The usc Board engaged Bob Springmeyer to advise on a Business Plan for the usc. Phillipe Wyffels, who'd we dubbed RealityMan for his financial perspectives, put together a preliminary plan. Later Phillipe 'found' Dennis Evans, a semi-retired cruise line executive to help him with financial and other 'reality' issues. Dennis consulted with usc-The Leo on financial and business plan matters. We came up with other interesting descriptors for our key staff:

Bill Pagels was IP Man (intellectual property),

Jody Ostrander chose Factotum,

Bob Johnson became VisionMan,

WebMan was Richard Lafon,

Mary Tull was Catalyst.

In February 8, 2003 the magnificent, new Salt Lake City Public Library opened, just ½ block North of the now 'old' library building. A large banner: TheLeonardo 2004 was mounted on the 'old' Library Building, now The Leonardo Building, thus generating widespread interest in and enthusiasm for Library Square. TheLeonardo/usc worked with Cogbox to develop logo, business cards, and other materials.

## Initial Fundraising

As a result of a discussion in my office at UU, and thanks to an introduction by Chris Johnson of Computer Science, Patrick Byrne, and the Byrne Family Foundation, donated \$100,000 to The Leonardo – the project's first major gift, allowing payment of existing bills to VCBO and continued planning and development.

Patrick Byrne and I had a fascinating conversation. As I recall, he has a Philosophy PhD from Oxford, traveled (via motorcycle, I think) and explored in Nepal or Tibet, got attracted and committed to Buddhist values and views, and was genuinely interested in creativity – and in Leonardo da Vinci. We really resonated. Byrne had founded a novel online firm *overstock.com*, counted Warren Buffett (a friend of his father's) as a mentor, and was genuinely interested in issues and politics. He later morphed into an influential Libertarian. Unfortunately, we did not stay in touch. Many years later I tried to reconnect, to no avail. As I write this (5–29–2021) Patrick Byrne is a pro-Trump millionaire pushing election conspiracy theories. So much for Leonardo and critical thinking!

In January 2003 The Leonardo initiated a contract with Lisa Kalantzes for capital campaign consulting services, conditional on her initial fund-raising successes. The Leonardo's first website was initiated at the same time: [www.theleonardo.org](http://www.theleonardo.org), designed by Cogbox.

A second large – much larger – gift was a pledge via Carolyn Tanner Irish, of the Tanner Foundation. She also served as the Episcopal Bishop for Utah. The pledge of \$1M over 5 years was the largest ever made by the Tanner Trust. Lisa had impressed Carolyn with the vision and potential for The Leonardo. The Tanner pledge put the project, finally, on a firm financial footing. Carolyn Tanner Irish said, when she made the \$1M Tanner gift public:

'We have a unique opportunity.

The Greeks have two words for time –

one for the chronological sense, and

one for the right time – for a unique opportunity.

The Leonardo is that unique opportunity.'

Some months later Lisa Kalantzes moved on to another position, leaving us to search for a development person. Fortunately Mary McDonald, who was directing CISE at the UU with me, had introduced me to Mary Tull. Mary had recently relocated to SLC and was involved in a variety of art and education activities. We had engaged her as a consultant for USC programs, including, I think, Science in Society and as an evaluator for LOW. Mary applied for the position. She was a great fan of The Leonardo vision and project. She was hired. Jody Ostrander had been working with Mary Tull in her teen education and achievement program. Mary and Jody joined The Leo at about the same time.

Clark (formerly Hansen) Planetarium opened in its new facility at The Gateway in April, 2003. It included an IMAX-like theatre and a six foot Science on a Sphere Earth visualization system.

## A ‘Renaissance’ Bond

In mid-2003 we discussed Les Kelen’s earlier suggestion of a City bond for upgrading and remodeling The Leonardo building. Soren Simonsen, a local architect who served on the CDA Board, was on the City Council; he cautiously encouraged the discussions. After some deliberation, Mayor Anderson concluded that a much larger ‘Renaissance Bond’ was feasible – totaling nearly \$70M (and including the \$10M we suggested for The Leo). This followed a Dan Jones poll which concluded that the City might indeed approve and manage such a bond. The bond was placed on the Nov. 2003 ballot.

A public meeting and review on the project in August received enthusiastic support and endorsement: Mayor Anderson gave a ‘green light’ to proceed with The Leonardo project.

The Salt Lake City Council formally put Proposition 2 on the Nov. 4, 2003 ballot, including a \$10.2M general bond for the upgrading and remodeling of the old main library to be used as The Leonardo. Four other bond initiatives were also placed on the ballot. Each bond initiative required a separate ballot vote. The entire bonding package was coined A Renaissance Bond. We then got to work!

At about this time it became very clear that we really needed an Executive Director for The Library Square Foundation and for the project. After some consideration and interviews, Mary Tull was appointed to the new position. She (we) immediately launched a bond awareness and education campaign. Our web sites:

[www.theleonardo.org](http://www.theleonardo.org) and  
[www.utahsciencecenter.org](http://www.utahsciencecenter.org)

were upgraded and enhanced with bond awareness content. We engaged the Zuhl media group, experienced in political campaigns, to plan, design, and engineer the effort.

Mike Zuhl led the effort.

Lisa Davis was working with Global Artways, providing their public awareness and publicity needs. The Leo team was able to engage her in our ongoing media aspirations and needs. She became an integral part of The Leo team and today, in 2020–2024, serves as Chair of The Leonardo Board.

After many weeks of community awareness work (posters, highway intersection wavings of signs), we gathered at the home of Mary Tull and Tom Goldsmith, just above the UU, to follow the vote counting on election night – Nov. 4, 2003. All five Renaissance Bonds were approved! Our bond was to be released within the next 5 years, but only when The Leonardo could demonstrate that it had raised a 1:1 match of \$10M for programs, exhibits, and services.

The bond would provide for the basic utility, seismic, and remodeling needed. A Capital Campaign would provide the required match – via The Leonardo Foundation (The Library Square Foundation for Art, Culture, and Science). We planned for a Federal directed appropriation (historically called a pork-barrel appropriation) of \$5M, specifically for education-related programming, and private donations totaling \$10M for program and exhibit development, implementation, and initial operations. We were ecstatic, confident, and eager to move ahead. We placed a large banner on the building, reading Thank You, Salt Lake City!: Leonardo 2005 – our initial opening date!

With the City, we issued an RFP for architect services in early 2004 for the remodeling and upgrading of the building. We were swayed by a presentation by Walter Crimm of Ewing Cole of Philadelphia, with AJC as their local architect. We were all interested in sustainability and highly energy efficient buildings – so was AJC. Phillippe and I pushed for LEED certification, solar panels on the roof (perhaps via Rocky Mountain Power’s relatively new Blue Sky grants program), and energy awareness and conservation exhibits and activities.

The plans and estimates from Ewing Cole ended up being costlier than we planned, but we were confident and optimistic. Our choice of Ewing Cole as the architect caused great concern for VCBO, who had worked with us, largely pro-bono, to develop the preliminary plans and sketches for The Leonardo in the old building.

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We also issued an RFP for exhibit design and planning, interviewed four or so finalists, and selected Gyroscope in Oakland, California. That proved to be a wise choice, leading to an effective, long, and ongoing collaboration. Marita Maedrano and Chuck Howarth, Gyroscope's two principals, had worked on the Liberty Science Center in New Jersey; they formed Gyroscope shortly thereafter. They were creative, eager, optimistic, full of ideas, and very keen on The Leo. We worked especially closely with one of their key designers, Don Pohlman – formerly with the Science Museum of Minnesota.

We selected Axiom of Salt Lake City as our branding/identity firm. Axiom came up with the dramatic and creative ehTLeonardo logo – a backwards 'The' attached to Leo or Leonardo. We printed black T-shirts with that unique logo and name, which became very popular.

In 2004 the National Academy of Sciences opened its own science center in downtown Washington, D.C., directed by Patrice Legro. The Marian Koshland Science Museum focused on two initial topics, of great interest and relevance to NAS and the nation:

Global Warming and our Future;

Putting DNA to Work.

As I was especially interested in global warming, I visited the Koshland, met Patrice Legro, learned that Tom Bowman was a principal designer of the exhibit, and reached out to Tom for discussions related to The Leonardo project. Tom served as a consultant, interacting with me, The Leo team, and Gyroscope in brainstorming and suggesting approaches to global warming and environment exhibits and activities. Legro later joined our science advisory board for The Leo. Other members included Brigitte Zana, Directrice du développement et des réseaux, Palais de la Découverte, Paris; Peter Giles, with The Tech in San Jose; and Tom Bowman.

The actual fabricators of the Koshland climate exhibit included Pinnacle Exhibits, and involved a man with several SLC clients and the local firm HB Stubbs: Don Szabo. Don was in the exhibits and trade show business. He connected with me and Phillippe Wyffels, and got Stubbs to – pro-bono – construct and install custom-designed office furniture for The Leo's new office on Library Square, under the sprawling curved ramp – an 'aerial' connection between the Library and Library Square. The Leo team had a great view of the Plaza, the old library (The Leonardo-to-be) and the new Library. КСРW, a local FM public

radio station, occupied the offices next door, broadcasting their content directly from Library Square.

## Flight! – 2005

On Feb. 18–19, 2005 The Leonardo organized and hosted Flight!, a unique 2 day program and celebration of Flight!, in preparation for the development of flight-related exhibits and programs in The Leonardo.

Thanks to Winter Horton, his close friend Paul MacCready was the keynote speaker, including a short video *Doing More with Less*. MacCready was a great fan of Leonardo da Vinci. Tyler MacCready, Paul's son, did demonstrations of his 'walk-along glider' activities, popularized by Alan Alda's Scientific American Frontiers program 'Flying Free'. Paul MacCready was an incredible engineer – the first to accomplish truly man-powered flight with the Gossamer Condor and then across the English Channel with the Gossamer Albatross.

Here are some MacCready quotes:

“You can do all kinds of things if you just plunge ahead. It doesn't mean you're any good at them, but you can be good enough.”

“...daydreaming is my most productive activity.”

“I'm more interested in a world that works than what sells.”

“We make strange devices that do more with less.”

MacCready died two years after his talk for The Leonardo – at the age of 81. As I write these perspectives, in May, 2021, I just learned that the incredible Mars mini-copter, Ingenuity, was made by Aerovironment, the company founded by Paul MacCready. Winter Horton died in 2009.

Mario Taddei, founder of Leonardo3 ([www.leonardo3.net](http://www.leonardo3.net)), is a developer and interpreter of Leonardo da Vinci's work and genius – by bringing his notebooks to life. He came to Flight!-2005 to present his unique interactive DVD/computer activities and full traveling exhibits on da Vinci's work. Mario had also scoured the Notebooks to try to understand da Vinci's long misunderstood self-powered, programmable! cart. His solving of the 'mystery' of the famous cart resulted in international publicity in 2004. I then reached out to Mario,

## Obrigado Pela Vida

and we began a discussion related to da Vinci and The Leonardo. I think Barb and I visited his shop in Milan in late June, 2004, after traveling to Bonn for Jamie Lee's wedding – Jamie and Tonio were/are very close friends. Mario and I met again, briefly, at the ASTC meeting at TheTech in San Jose, Oct. 2004. Mario had an exhibit related to StudioDDM, the precursor to his Leonardo3 firm.

We had arranged for Mario and Frederico, his collaborator, to ship one of their da Vinci carts to us for re-assembly (by them!) and demonstration in the new City Library foyer just before the Flight! event. It arrived, they assembled it in The Leo Building basement (I helped, a very little). It worked – beautifully. Mario also gave two talks – one on Flight! and the other on Leonardo's Cart. His Flight talk used the remarkable graphics he developed and applied to explain and even demonstrate da Vinci's remarkable ideas and mechanisms.

The Flight! events also included David Widauf, the brains and builder of Utah's '1905' Wright Flyer – he designed it and, with USU students, remade it for the centennial anniversary of the Wright Flyer. Dave's talk was titled: Yesterday's Airplane Built with Modern Materials. He showed videos and discussed Jake Garn's test flight. Garn almost crashed it! Dave Widauf died in 2010.

The Flight! event included videos, workshops, and exciting talks, enthusing all participants about Leonardo da Vinci and especially his fascination with Flight! Mario's remarks and accomplishments led to extensive discussions with him and Leonardo3 related to a full da Vinci 'presence' or 'flavor' in the new The Leonardo.

We were so excited we proposed a Flight! advisory team to assist with planning and development, including:

Jake Garn, former Astronaut, US Senator, and private pilot

Mario Taddei and team at StudioDDM in Milan, experts on Leonardo's inventions and drawings

Don Szabo of Pinnacle Exhibits

Henk Tennekes, author of *The Simple Science of Flight*, with the Free University of Amsterdam

Paul MacCready, Aerovironment, Inc. and designer/builder of man-powered aircraft

Leu Nashner, President of NeuroCom, private pilot and expert on balance



Dave Widauf, prime mover of the Utah State University Wright Flyer (1905) team and project

Bill Patterson, Cal Poly, man-powered helicopter project

Kuan Chen, Univ of Utah, aeronautical engineering

John McIntyre, designer of AirGlow man powered aircraft, Cambridge, UK

Joe Andrade, Chair; Director of the Utah Science Center and Professor University of Utah

The year following Flight! Phillipe Wyffels visited Mario in Milan. Mario and I talked again at the ECSITE conference in Milan in 2009. We never did have a meeting of the Flight Advisory team. Some years later MacCready, Widauf, and Horton died, and Flight! receded in our planning.

Leu Nashner's firm in Portland, OR worked with us on an interactive balance exhibit for LOW and Jake Garn continued to endorse and support the project in the local business and political community.

The Leo did open a major Flight! exhibit in 2016, which included a C-131 transport and a Mig 21 fighter hanging inside The Leonardo, with information on Garn, the Space Shuttle, the Moon landing and walk, Paul MacCready and the Gossamer woman – powered aircraft.

There was no further interaction with Mario until 2021, as we began planning for The Leo's 10th anniversary – and the 5th anniversary of our current Flight! exhibit. That interaction is ongoing.

## **Just in Case! – SLVSEF, LOW, Exhibits**

As The Leonardo was not yet a done deal in 2004–5, the conservative USCA continued its activities in behalf of a Utah Science Center – just in case!

I had always been a fan of student science fairs. There was a Salt Lake area fair but it really could use revitalization and enhancement. So the Utah Science Center agreed to assume responsibility for the SL Valley Science and Engineering Fair (SLVSEF). Ray Beckett managed the fair in 2003–4, via the

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UU; he was almost eager to turn it over to USC. Ray worked closely with Peter Gerity, who had worked with me as Dean and with PSI.

Jody Ostrander served as Exec Assistant to Utah Science Center and as Manager of SLVSEF. Richard Lafon and Peter Doenges, both volunteers, developed an extensive (and somewhat over-complicated) SLVSEF web site. SLVSEF-04 was conducted under the direction and management of USCF, with the co-sponsorship of the Univ. of Utah.

We also began discussions with USU regarding Discovery on Wheels. With the progress towards The Leonardo, we wanted to move ahead with outreach and related programs. USU was having financial difficulties with DOW, so they readily agreed to a re-transfer back to Salt Lake City – to the Utah Science Center, effective Summer, 2004. USCF began discussions with the Utah State Office of Education regarding needs for outreach and informal science education. I made contact with EnviroCare Utah, owned by Khosrow Semnani. Mark Walker, their head for community relations, confided that EnviroCare was considering its own on wheels state-wide outreach effort, partly as a PR project for the firm. We agreed that a joint project made more sense. EnviroCare became the primary corporate sponsor of Leonardo on Wheels. We changed DOW's name and focus back to LOW, with a middle school/ junior high curriculum program. The formal name became THE Leonardo on Wheels – Science (LOW-S).

Mike Anderson, a UU Bioengineering graduate student, was hired as LOW-S Director; Jody served as Manager. Our plan was to house the LOW truck and a new trailer in the Library parking area when it wasn't on the road. We learned very quickly that the large 30 foot trailer USU had been using for the DOW program was simply too large for the parking structure under the library building. We actually had it stuck down there for a short time! Having some dollars via the EnviroCare sponsorship, Mike and I looked for a trailer, finally acquiring a 25 ft. one, soon sporting a great LOW design by Cogbox. USU kept and then sold its trailer.

Mike Anderson and I worked very hard to develop all new exhibits for LOW-S, together with my UU students and volunteers, including Moses Yang, Rashmi Prasad, and Noah Ledbetter. Noah became a part-time staff member. Mike adopted a robust aluminum component large wheel mobile cart system, which he designed, for the various mobile exhibit stations. We worked with Susan Johnson of Futura Industries in Northern Utah for a very favorable rate

for their components. We had learned, via Suzanne Winters, that Futura's CEO was a great fan and supporter of science-tech education.

LOW-s was launched at the City Library foyer (the Urban Room), in October, 2004, as a festive event involving EnviroCare officials, USOE, USCF Board, USCA Board, The Leonardo staff and officials, and the general public. We had good publicity, a new, colorful trailer, a dilapidated truck inherited from USU to pull it, and Mike Anderson. We were on a roll. As the program expanded with LOW-s gigs throughout Utah, we added staff in addition to Mike, Noah, and sometimes Jody or me. Mike finished his graduate work and then moved on to a full-time position in a local orthopedics technology firm, then later to Ft. Collins, Colorado.

LOW was now part of Jody Ostrander's 'portfolio' and responsibilities. In 2005 Rodney Kopish was hired, recommended by Mary McDonald Rogan, who had worked with Rodney when he was in Berkeley. Tony Anderson was hired a little later, and then a year or so later Jeanne Huelskamp. LaraLee Smith came on board as a coordinator and scheduler. Later Ross Chambless, who was working on a Masters in Environmental Humanities, joined us to prepare press releases and other media related to LOW. We especially wanted exposure in rural Utah media, to help educate rural legislators on LOW and on The Leonardo. Rodney, Tony, and Jeanne were with LOW for several years.

2005 was a very full year. During the Flight! activities, we were all working closely with Ewing-Cole on building architecture and remodeling, and with Gyroscope on program and exhibit planning. In 2005 USCF engaged Kay Denton as a grant and proposal writer, part time, then nearly fulltime. She also filled in on LOW.

At that time LOW was housed partly in my UTU lab, with its truck and trailer in the parking area under the old library building. Later we partnered with the then new Salt Lake Center for Science Education (SLCSE) in the Rose Park area. There was space for LOW to have an exhibits lab and shop, space for the old truck, and semi-secure space for our new trailer. Some years later, Fall 2009, I taught an energy via video class at SLCSE. The student's videos are on YouTube (search SLCSE Energy on YouTube).

In late 2005 I met Steve McQuinn, a freelance graphics person. Steve was fascinating. He had great computer graphics and visualization skills and would work for almost nothing.

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In 2006 he made an interactive map of Utah with LOW gigs noted and described. He was a fan of the then new Google Earth. Steve called himself an 'information architect'. He provided ideas, sketches, and discussion in many facets of the Leonardo and LOW. Steve also helped with manual labor needs, moving and organizing exhibit resources in The Leo Building basements, and sorting old exhibits for donation to a science center at Weber State University.

In May 2005 Will West and Jeff Unruh accepted appointments to the USC Board. I had sought out Will after learning of his entrepreneurial advocacy interests and his successes. I think we first met after a talk he gave in the UTU Union to students, perhaps a career fair. He became interested, got involved, and later chaired The Leonardo Board.

Jeff Unruh and I had met earlier at a tech networking breakfast sponsored by the state. He and Polly had two boys and were interested in science center-like experiences. He served later on The Leonardo Board as well. He was instrumental in getting Peter Giles to join The Leonardo as Director to facilitate its opening in 2011.

Rashmi Prasad finished her MSc work in mid 2005 with demo exhibits and a thesis on bioelectric signal processing. I had involved Steven Poelzing of CVRTI (the UTU Cardiovascular Research and Training Institute), who started to develop a set of activities we called The Body Electric! Rashmi was also helped by Ken Horch and Reid Harrison at CVRTI. We looked at novel and effective means of recording personal EMG, EEG, and ECG signals, including some very exploratory work on noncontactless detection of bioelectric fields. Although we were well on our way with some very novel and potentially popular personal activities, Rashmi finished and left the area, and Steven took a new position elsewhere.

From the very beginning of The Leonardo, Steven Kern and I wanted to do exhibits on YOU! – The Visitor. We had a slogan: You are the Experiment – at The Leonardo!

In October, 2005 the Center for Documentary Arts (CDA), in partnership with The Leonardo, the Salt Lake City Film Center and the University of Utah's College of Humanities, presented 'Exodus,' a 300-piece exhibit by reknown documentary photographer Sebastião Salgado. Exodus, also called Migrations, tells the story of the unprecedented displacement of millions of people at the close of the 20th century due to war, natural disasters, environmental

degradation, and the widening gap between rich and poor. This was the first public venue in the old library building under its new planning and vision. Les Kelen of CDA and Robert Neuman at the UTU were the key players in hosting this exhibit in Utah.

## Leonardo's Laptop – Fundraising

We brain-stormed ways to interest Micron, a local microelectronics firm, with headquarters in Boise, in The Leonardo. I had recently acquired a book called *Leonardo's Laptop*. This spawned several discussions – what would Leo have on his laptop? Micron was pioneering nano-sized storage media, which became the now ubiquitous thumb or flash drives. So we now asked how might da Vinci have used flash drives? IM Flash was a Micron-based new firm with a new, massive nano-manufacturing facility just south of Salt Lake City. We made contact with Stan Lockhart of IM Flash and others. That led to a small proposal and the beginning of support from the Micron Educational Foundation. Later a colleague of Phillippe Wyffels, Bill Jahsman, ordered 1 Gigabyte (GB) flash drives mounted on a bracelet labeled *ehT Leonardo*, which we gave to teachers and others in our LOW travels. They were great awareness tools for many years. Some 10 years later Micron was starting to make 1000 GB (terabyte) chips! Over the years Micron gave at least \$1M to TheLeo to aid with LOW and the 2011 museum opening.

In June, 2004, while in the Bay Area, I had arranged to visit Ed Catmull, head of Pixar, in Oakland, CA. Barb and I recall driving into a visitors' lot there and entering the gate. The entire facility was fenced. We had an appointment, so we were quickly processed and allowed in to a large lobby with Pixar posters and exhibits. The coolest thing for us was our Pixar Visitor name tags: A Stranger From the Outside: ...

Ed Catmull was a Salt Lake veteran and graduate of UTU Computer Science, with ties to the College of Engineering. So I wanted to interest him in The Leonardo. We had about 15 minutes together. I discussed the idea, the building,

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the plans, and the need for \$\$\$. He knew that was the goal, but did not commit. He did seem genuinely interested. But I didn't really pursue the interaction, and neither did The Leo – or Catmull.

From 2005 on we worked hard to obtain modest funding from the state via their program for informal science education (this became the informal Science Education Enhancement – iSEE – program of USOE). I also contacted most of the area's technology-based companies, requesting them to support LOW and The Leonardo: L-3, Rockwell-Collins, Battelle (who managed the Tooele Army facility), EnviroCare. SLVSEF and Science in Society also needed sponsors. We worked with the state, businesses, philanthropists, and the general public to raise the dollars and pledges.

Thomas Stockham was a digital music pioneer, a professor of Computer Science and Electrical Engineering, and the founder of Soundstream, the first digital music company. He'd died in 2004 of Alzheimer's. I profiled and discussed his thoughts on creativity in Chap. 9 of *Science without Walls*. Several of us thought an interactive on digital sound and music would be perfect for The Leo – and a way to honor Tom's many accomplishments – including use of his methods to try to enhance Richard Nixon's clandestine Watergate tapes!

I thought the family would be interested in helping and perhaps supporting such an exhibit. Robert Johnson and I visited Martha, Tom's widow, to discuss the project. I also wanted to connect with his sons, especially John, Jr. – who'd been a student of 'mine' at the Open Classroom back in 1980 or so. They were becoming known as local entrepreneurs and might provide some resources. The Stockham family had some ranch property, including a house, in the foothills of the Henry Mountains, in far southern Utah. Martha said I could talk with the entire Stockham family at the ranch at a rare family reunion, in Sept. 2005. I drove to Hanksville, then on to the Henry Mountain road to their ranch house location – a rugged, beautiful setting. We talked, I presented, they listened, I left. There was some interest, but I got distracted with other duties and priorities.

## Fundraising and Jim Sorenson

Mary Tull and I worked to interest Jim Sorenson, the local biomed industry businessman and entrepreneur who was then a near billionaire. I met Jim back in my UU ESCA days, when I worked with Physics Dept. Chair Peter Gibbs to invite the ESCA pioneer and physics Nobelist Kai Siegbahn to lecture in the College of Science's Frontiers in Science series. Jim may have given Pete a pittance to help at that time.

Sorenson had an interesting history. He'd been a pharmaceutical salesman in the 50s, when he and two other salesmen, Dale Ballard and Victor Cartwright, founded in 1956 a startup called Deseret Pharmaceutical. Their timing and hunches were right. The firm became known locally as Deseret Medical and grew rapidly.

In early 1991, as Chair of the Bioengineering Dept., I hired then grad student Jeff Weiss to prepare a historical report titled *Why Utah? Bioengineering in the Wasatch*. Jeff interviewed Sorenson and many others who were active in the earlier days of the Utah biotech scene. Rumor has it that Ballard and Cartwright invited Sorenson, who was selling for a different pharmaceutical company, to join their endeavor. They thought that would prevent Jim from being a competitor. Thus the three of them joined forces.

Deseret Medical was sold in 1976. Ballard went on to found Ballard Medical; Sorenson founded Sorenson Research and then a suite of Sorenson-named firms. Their forte was disposable medical products.

I met Dale Ballard at his modest office in Midvale, south of Salt Lake City, probably in 2002.

I did ask about Jim Sorenson and his role in Deseret Medical.

Ballard laughed:

"You know that I fired the little bastard, don't you?" he asked.

I hadn't known.

Dale was not interested in The Leo or in philanthropy focused in the City.

"I never travel north of Murray," he said.

He said he avoided the city, preferring the rural lands in the south valley.

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We never received anything from Ballard, nor from his son, Dale, Jr., whom I chased for some time in 2003. After Dale Ballard's death in 2005 I tried to again contact Dale, Jr. – without success.

I knew Gary Crocker, Sorenson's son-in-law, via my technical collaborations with Sung Wan Kim. Kim and Crocker were cofounders of TheraTech, a novel drug delivery firm located in the UTU Research Park. Crocker was key to the sale of Sorenson Research in 1980 to Abbott Medical. That sale, for \$100M, made Jim Sorenson the largest individual shareholder of Abbott, and a multi-millionaire. Jim soon became a billionaire as Abbott grew and grew. Gary and I talked several times about approaching Jim to help with The Leonardo. I tried to meet Jim. He was familiar with my *Science without Walls* TV show, saying he'd watched parts and liked it. Several times I would just sit in the waiting areas of his modest Sorenson Companies office on West Temple St. just waiting for him to enter or leave – to get his attention. It worked. We really did recognize and like each other.

After much cultivating and work, including a personal demonstration of a tabletop Magic Planet 3-D Earth interactive visualization system, Jim finally agreed in 2006 to pledge \$15M towards The Leonardo. The funds would be partly used for a major remodel and expansion of the North face of the building and for exhibits related to Jim's interests in genetics, genealogy and data visualization. We were elated. We kept working with Jim and his technical staff to facilitate the goals of the gift. Then as we moved hard to 'cement' and implement the pledge in 2007, Jim said he'd changed his mind! And now we were devastated. We had heard from others that he was not always reliable and couldn't be fully trusted. Now we understood. We carried on.

Jim did indeed give some money to The Leo, but just a fraction of what he'd originally pledged. We learned later that he was afflicted with cancer; he died in Jan. 2008 at the age of 86. His philanthropic interests were carried on – and expanded – by the Sorenson Family Foundation, now the Sorenson Legacy Foundation, which has provided some modest funding to The Leo over the years.

In mid-2006 I learned of the Utah State University (USU) NASA grant to provide intern support for Utah undergraduates studying in NASA-related fields. Mike Keene had recently served as the Governor's Science Advisor. He, John vanderFord of USU, and I met and talked regarding UTU student interns working



on NASA-related exhibits for the Utah Science Center project. We distributed \$3000 in early 2007 for three interns. In subsequent years the allocation grew modestly, until it ended in 2010. The interns and I worked closely with the UU Department of Geography.

The projects focused on Earth 3-D visualization activities using modern GIS (geographic information systems) software and visualization tools. We worked on major exhibit planning: Planet Place and Center for the Big Picture. When we acquired a small Magic Planet visualization/projection system (for the demo and appeal to Jim Sorenson), the interns employed it very creatively. We prepared several posters, gave several talks, funded a dozen or so interns. Modest funds, very effectively employed – and very helpful to USC and The Leonardo.

One of the interns was Jacob Hanson, a recent UU BioE BSc. graduate. Jake and I began working closely together on a range of projects related to computers, visualization, and websites.

## *A real The Leonardo*

Later in 2007 The Leonardo Board had extensive discussions on the organizational and administrative needs of an integrated The Leonardo rather than a set of ‘partners’ as part of an ‘umbrella’ organization. To facilitate the integration and development of The Leonardo, Joe Andrade, Chair of the Utah Science Center, and Leslie Kelen, Chair of the Center for Documentary Arts, in late 2007 formerly resigned from The Leonardo Board and were replaced by new Board members with interests in the sciences and arts.

This was difficult as Les and I had been operating on the assumption that our separate organizations would remain autonomous and independent in The Leo building under the Library Square Foundation umbrella. I resonated with and supported the idea and need for a fully integrated Leonardo, whereas Les insisted on his independence – on CDA’s full autonomy – and wasn’t especially interested in the sciency side of Leonardo. Les was annoyed with me for not insisting on the USC’s full independence. The agreement held – the project was now about a cohesive, unique THE Leonardo.

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Alexandra (Alex) Hesse moved back to Salt Lake City in Spring, 2006. She had been working in Sydney, Australia, but had earlier worked in 2001–2 for the Olympics Coordinating Committee in Salt Lake City. She contacted The Leo and was interviewed by Phillippe Wyffels. Denise Martinez, our then exhibits coordinator, had just left, so Alex was considered for the Exhibits Manager position. We were all impressed with her. She was hired and became indispensable!

The Leo Board and the USCF Board were each concerned with the slow progress in fund-raising needed to meet the required bond match and to get the City to certify and release the bond, so we could move ahead with upgrading the building and to opening The Leonardo.

The Utah Science Center Board discussed bringing on an experienced science center individual who could help the project. Several of us, especially Jeff Unruh, knew that Peter Giles, the first and long serving director of The Tech in San Jose, CA, had just retired (2007) and had close ties to Utah. We had sent a delegation earlier to visit The Tech for perspectives and ideas which could be applied to our own project. Giles visited and, after some gently cajoling, agreed to help The Leonardo to open. Initially he served as a consultant advisor. Fairly soon it was clear to the Boards that he should become Director to facilitate his interaction with local donors, legislators, and the business community. He agreed and accepted the assignment, with the goal of opening the facility. He had to trim expenses, including moving the project office from Library Square to cheaper space at 1st South and Main in downtown SLC. The Leonardo had been spending its limited resources, mainly from the Tanner grant, far too rapidly.

Giles replaced Mary Tull as Director in early 2008. This was difficult for Mary and most of the staff and supporters of The Leo. Mary left. Alexandra Hesse became the Asst. Director. Phillippe Wyffels' position was also ended. The Salt Lake City Mayor and Council had been critical of The Leonardo. Giles had to deftly redevelop confidence and interest in The Leo's potential and usefulness for Salt Lake City. Mayor Ralph Becker and the Council required lots of attention to get the project on a semi-solid footing. They had become jaded to promises, well intentioned but often not fully realized.

The City finally certified that The Leonardo had indeed raised the 1:1 match required by the Bond initiative, and thus the \$10M for building remodeling

could be released. The Leo Board encouraged a new board member, architect Allan Roberts, to take a creative red pen to all the plans and provide a path to proceed with remodeling and upgrading the building within the budget of the \$10M City bond. He did!

Somehow the Board and the City were able to sever the original agreement with Ewing Cole and proceeded with a local firm to finalize a revised set of plans. The Leo exhibit staff and Gyroscope also greatly adjusted their expectations.

## BodyWorlds – 2008

In early 2008 Alex interacted with the BodyWorlds (BW) organization during their exhibit at the American Society for Museums (ASM) meeting in Los Angeles. Although they were booked 3 years in advance, they did tell Alex they had a hole in their schedule for late 2008. When Alex reported back, we were all enthused and urged/delegated her to move forward with booking BW for The Leo. It was not easy. We had no formal title to or access to the building. Peter and Alex had to negotiate for a temporary lease with Salt Lake City. Dennis Evans helped with that discussion, as well as worked with the BW team on the interior building modifications needed to house the huge exhibition.

After considerable discussions, including difficult ones with Salt Lake City regarding the building's use and necessary modifications, BodyWorlds<sup>3</sup> opened in Sept. 2008; it was subtitled The Original Exhibition of Real Human Bodies, with a companion exhibit The Story of the Heart. The installation spanned nearly 20,000 square feet and featured more than 200 human bodies, allowing visitors to learn anatomy, physiology and health by viewing the real thing. The exhibit ran for about 4 ½ months in The Leonardo Building.

After visitors completed the exhibit, they exited through a small interactive science center consisting of LOW-like activities, including a hands-on dissection lab manned by UTU human anatomy students. Our new 'ButtPrint' pressure visualization bench was popular; so was 'Risk, Choice, and Chance', featuring a throw of the dice simulation and graphics. This exhibit was

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stimulated by my interactions with the Society for Risk Analysis (SRA) and by the Unruh Foundation. Jeff Unruh's father, who set up and endowed the Unruh Foundation, had a strong interest in the teaching of risk, chance, luck, and statistics.

We also had our small, interactive Magic Planet on display (the one we acquired and used to impress Jim Sorenson!). We used the data files of the NIH Human Anatomy project to present *A Slice of You!* – a unique, new exhibit developed by Jae Kim with great help from the UU's Doug Christensen. As you walked towards the graphics monitor, it displayed vertical slices of 'your' anatomy. Actually the visitor's position triggered the display of a slice of sectional data from the onboard data base. But it did feel as if you were the one being non-invasively sectioned and imaged! It was very popular.

Lisa Davis served as The Leo's spokesperson for and during the BW exhibit. There was considerable media and public interest. The Leo was open for 24 hours during the final days of the exhibit, including New Year's Eve and Day. We were part of Salt Lake City's First Night festivities.

Barb was in Mexico at the time, with her best friend Fanny Blauer. I was alone on a very cold New Year's Eve. I spent the entire night at The Leonardo, helping entertain the long lines with several portable exhibit activities. Especially popular was a small hand held infrared video camera (ThermaCam), which I'd borrowed for several days from the local rep for FLIR Systems. I would shoot images of people coming in from the bitter cold. Most had never seen such images, as thermal imaging was still an expensive technology. Today you find it on some smartphones and app add-ons.

There were lectures, panel discussions, a Science in Society event on Birth and a second one on Death. There was extensive coordination with the education systems, especially middle and high schools – and home schoolers.

The exhibit and associated activities generated great interest in The Leonardo project. It also demonstrated to the City that, Yes!, The Leo can indeed handle a major exhibit, the staff can handle and serve visitors, and The Leonardo could indeed provide outstanding entertainment and educational experiences.

## STEMWorks – 2008–9

Thanks to Dr. Tami Goetz at SLCC I became aware of biotech education and career interests and programs at SLCC and later in the state's related economic development offices. Tami and her coworkers succeeded in getting a large US Dept. of Labor grant in 2008 awarded to the State of Utah, via the State's Dept. of Work Force Services. The large grant was part of the Workforce Innovation in Regional Economic Development (WIRED) initiative, a Federal effort for STEM-related education and career paths for K-12 students, science and math educators and the general community. Tami and I had been discussing The Leonardo and Leonardo on Wheels, so we included an LOW-like component in the WIRED proposal. We focused the activities on biology and biotech, whereas the 'standard' LOW fare was focused on the physical sciences.

In late 2007 I received an inquiry from a member of the staff of the Maryland Science Center in Baltimore: Mary Anter. She had a great background for the WIRED project and was interested in relocating to Utah, as she and her boyfriend were avid rock climbers. I also met and interviewed her at the Maryland Science Center during a visit to Baltimore, probably in late 2007. Alex and I interviewed Anter in Salt Lake City in early 2008. Alex was also impressed, so we hired her.

Thanks to Mary Anter, our WIRED program was called STEMworks. We developed the concept of Flexibits which could be folded and packed into a sedan or even on public transit. They were portable, foldable, easy to transport hands on activity work stations which we delivered to high schools in the urban area in 2008 and 2009. We also set up displays, short workshops, and presentations. The Leo graphics team designed four magnificent standup posters to draw attention to our displays, one each on:

Photosynthesis

Respiration

Molecules

Cells

We also did one on Energy for a special energy workshop I would often present, weaving in considerations of climate change, fossil fuels, and CO<sub>2</sub>. I used a hand-powered electrical energy generation system hooked to old style

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filament, fluorescent, and later LED lights to physically demonstrate the energy inefficiency of the various lighting technologies. Users literally felt the work required to generate the electricity needed to light each of the different bulbs. We had a similar activity on LOW, build by Bob Wright and an electrician friend of his. It used a recumbent exercise bike equipped with a generator feeding an array of lights. Kids would compete as to how many lights they could power and for how long. This was a standard, very effective, science center activity.

We used an array of cool sensors from Vernier Instruments to directly measure CO<sub>2</sub>, O<sub>2</sub>, temperature, conductivity, etc. We had interactives on magnetic induction, static charge, and the general basics of electricity and circuits. We had small solar panels so participants could directly experience the ‘magic’ of photovoltaic electricity generation, as well as a small wind power demo unit.

I organized a session at the Honolulu ASTC meeting in Oct. 2010 to present our Flexibits and STEMwork developments and activities. It was a full session, called ‘Flexibits, Community Events, and Facilitated Involvement’. We had two world reknown science exhibit developers from England participate via Skype – successfully! Steven Pizzey of the firm Science Projects in London, and Ian Russell of Interactive Science, near Manchester, gave terrific Skype-live talks. tolerating the ten hour time difference! Mary Anter and I also spoke – and we had a very good interactive discussion.

The work of The Leonardo’s Jacob Hanson and Hugh Bollinger on our Big Picture project (On Line – All the Time!) was also highlighted, as was our cool STEMworks CO<sub>2</sub> molecule kit (Bonds, Springs, Energy) for understanding why CO<sub>2</sub> is a ‘greenhouse’ gas.

We produced, printed, and distributed a very effective STEMworks-Biotechnology booklet using the graphics of the four posters and presenting the grand Yin-Yang of Planet Earth: Photosynthesis < > Respiration via Cells and Molecules. It’s at [joeandrade.org](http://joeandrade.org) under Science and Society.

Although Flexibits and STEMworks efforts provided a great foundation for The Leonardo, those outreach activities stopped when the WIRED grant ended. The Leo limited staff was so busy on opening the museum that there were no resources for ongoing WIRED activities.

## The Leo, LOW, and SLVSEF

The Legislature added, in 2007, LOW-s to the ‘regular’ iSEE (Informal Science Education Enhancement) program of USOE, providing a firmer financial foundation for the program.

In Feb. 2008 we implemented a small The Leonardo installation in the Southtowne Mall, adjacent to their Victoria’s Secret shop! This was for the staff to get experience with a real public in a very commercial environment. Alex secured the venue. Dennis Evans greatly assisted with the set up and implementation. Jeff Unruh, Hugh Bollinger, Mary Tull, and I were all involved, as well as other TheLeo and LOW staff.

In 2009–2009 I was making many well illustrated presentations to generate awareness of, interest in, and support of The Leo and LOW. I spoke to Home School groups, the Utah Education Association, Utah Science Teachers, etc. – to essentially all groups and conferences containing people who should be interested in The Leonardo. SLVSEF continued to be an efficient and effective awareness and motivation tool for the community.

## Connections, Patterns, the Digital Leo

Leonardo was all about connections, patterns – the order and disorder of the natural world. He was unique in that he could not only visualize those patterns and connections, he could also draw and represent them so others could share his visions and perceptions. He invented the exploded and expanded drawing, allowing one to see into and through structures, much like so-called ‘x-ray vision’. He did his dissection experiments to understand anatomy and physiology and then reproduced those structures on paper so others could experience them without having to do dissections.

My mentor, Willem Kolff, was no Leonardo, but he would often do and use simplistic sketches and drawings – and he expected his coworkers to do the same. Most really creative and innovative people have such visualization skills, even if their drawing skills may be limited. Einstein literally ‘saw’ relativity in his mind, via a moving train. Feynman had his van painted with his vector-like diagrams of fundamental physical sub-atomic particle interactions. De Gennes used simple models of polymers at interfaces. Science is full of such simplistic sketches – sort of visual hypotheses as to what might be going on.

Fascinated with cartoons, comics, caricatures, and diagrams, I’d often try to use simple sketches to try to illustrate mental models of what might be going on at surfaces and interfaces, especially related to proteins at interfaces. And I encouraged my coworkers to use what skills they might have to illustrate their papers, reports, and ideas. Many were really very good: Li Feng, Mindy Meservy, many others. We augmented the simple sketches with data visualization tools, especially multi-variate plots (radar or star plots, for example).

All that attracted me to James Burke, his evolving Knowledge Web, and his *Connections* series on BBC. Burke gave a lecture some 25 years ago, either at UU or in the SLCPL, on his Knowledge Web, and his corps of volunteers working to develop it. I was very impressed. Burke’s connections were mainly via geography and time – essentially a semi-visual historical network, with a strong discovery and technology emphasis.

So in late 2006, perhaps early 2007, when I was approached by Joe Firmage about his vision of a Digital Universe – I became very interested. He proposed developing an online *Encyclopedia Galactica* – it could be easily accessed to facilitate creative education and research – a very complex, very visionary project. He felt it would be ideal for The Leonardo. Carl Sagan had used the term Encyclopedia Galactica back in 1980 in *Cosmos*, although it was first conceived by Isaac Asimov in 1942.

Jake Hanson and Hugh Bollinger also became interested in Firmage’s ideas and plans. Firmage had found Rasmus Groth, founder of LILA, a Danish startup working on visualization and networking software. It later became [AHEAD.COM](http://ahead.com). Groth came to SLC in 2009 and did an extensive workshop for us, installed a beta version of the Lila-Ahead software, and Jake Hanson and Hugh Bollinger began to collect images and other content with which to provide stories and curricula for a project we called A Big Picture. We set up a URL and website of



the same name to house our preliminary efforts. This was well before Prezi and other flexible, interactive, zoomable presentation and visualization software became available.

Hugh had a friend in the Mellon Foundation. Our plan was to put together a comprehensive example on a single subject to present in a request to Mellon for significant funding. But we didn't get that far. Hugh and Jake's work as consultants was stopped in 2009 as Peter Giles wanted to focus all resources on Opening. That was probably a wise thing to do, but it stopped a number of efforts which would have greatly aided The Leo's programming for and after opening. Joe Firmage had his own personal issues – his vision and preliminary plans for his ManyOne network sputtered and then ended.

## LOW, SLVSEF, and Sustainable Futures

In March 2009 SLVSEF completed its 5th event under USCF management, growing and improving each year. We recognized Jody Ostrander's work in developing SLVSEF over the past 5 years. A Five Years of SLVSEF/USCF report was prepared and made available in June 2009. Jody left in early 2010, together with SLVSEF, to the UU's new Center for Science and Math Education (CSME), working with Hugo Rossi.

We also celebrated 'LOW: Five Years on the Road' with a June 1–3 program at the City Library, recognizing LOW-s staff, sponsors, teachers and students. A 'Five Years on the Road: LOW-s' report was made available. We had earlier secured Larry Miller Foundation funding to allow Rodney Kopish to secure a more reliable truck with which to securely pull the trailer.

It was fall 2008, I think, when I received a call from an AT (Jai) Jaikumar. I was meeting in The Roasting Company site in the Library foyer on some USC or LOW matter. He had just relocated from India to Salt Lake City; his wife Brinda was working for Goldman Sachs as a trainee. He wanted to do something with USC or The Leo – as a volunteer. So we met. He had an engineering background,

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including transportation, autos, planning and project management – and great computer skills. He became part of the LOW team.

Jai and I then worked with SLC on their fuel efficiency and driver safety programs. We submitted a large proposal titled Fueling Sustainable Futures (FSF): Pathways to Foster Awareness, Understanding and Action to the DOE Clean Cities program in early 2009. It was a close collaboration with Robin Erickson, Utah Clean Cities Coalition Director, and the USC. We had folks from UU, USU, USOE Driver Education, and others. Shea Wickelson Pickelner, our local ‘biodiesel lady’, was a key part, together with her ‘biodiesel bus’. We proposed to do demos and workshops throughout the region. But FSF was not funded.

Jai transferred from LOW/USC to The Leo to help with planning and management of The Leo building’s remodeling. He worked under Dennis Evans. Dennis was not really into computer-aided project planning and management. He didn’t fully appreciate Jai’s skills or contribution. Jai left and took a job up the road at Autoliv, a major airbag manufacturer and then on to their facility in Michigan. We’ve stayed in touch, meeting and playing with son and daughter Aadi and Anjali.

The Leo and LOW were invited to a special Art and Science festival in late November, 2008 – in Bluff, Utah. Barb and I had never been to Bluff, although I’d earlier traveled to Monticello and Blanding with LOW. We rented a Van and filled it with a set of LOW exhibits. We also packed up FlightSim, a unique flight simulator experience developed for us via Rockwell-Collins (RC), the successor to Evans and Sutherland. Stacy Pearce, an RC engineer, was from Bluff and would be at the Festival – and help ‘man’ the FlightSim exhibit. She wanted to interest local students in technical careers.

Other prototype activities included Under Pressure, also called Butt Print, our pressure mapping prototype exhibit. I think the ultrasound carotid artery visualization exhibit was also included.

We enjoyed Bluff, met some interesting people, and likely inspired some kids. A good trip and gig. I think we also met with the dynamic and persistent Janet Ross who founded and opened the Canyon Country Discovery Center in Monticello.

## Giles, Merger, No NDA, Opening

On June 5, 2009, USCF and The Leonardo Boards met and voted to implement a merger of the two organizations, with The Leonardo becoming the final entity. I felt comfortable in the action as it indeed appeared that The Leo would finally open and become a reality.

Peter Giles wanted me to sign a nondisclosure agreement (NDA) as part of the merger action. Dennis Evans was helping Peter with the documentation and legal issues. I wanted nothing to do with NDAs. I had refused to sign them when I was consulting with major bioengineering firms. I simply told my clients to not tell me anything they didn't want disclosed – that it was too difficult for me to honestly remember what I learned and when and from whom. That annoyed Peter, amused Dennis, and entertained me.

Les Kelen the founder and director of CDA, one of the original three partners in The Leonardo, was also annoyed with me. He thought I was giving up by merging the Utah Science Center, also an original partner, into The Leonardo. CDA was clearly Les' s organization; he simply wanted to insure his own intellectual independence. So did I, but I aligned my interests with the art-science vision of The Leonardo rather than with total autonomy. Merging meant I would no longer have any direct responsibility or fiscal/budget authority.

Peter Giles had difficulty with people he felt were overly critical of his management decisions. Soon after he assumed full responsibility for USC and LOW, he dismissed Rodney Kopish, and a little later Jeanne Huelskamp. Their loss greatly hurt LOW and impacted STEMworks. Peter claimed he had to cut budgets, but it was really because he was too authoritarian to listen to people who often communicated passionately. Rodney was occasionally a bit of a pain; he sometimes seemed to not be as fully committed as others on the team. Jai Jaikumar, Kay Denton, and Jody Ostrander helped staff LOW. Peter was so committed to getting The Leo to open that he wasn't very committed to LOW or other outreach-type efforts or programs, including STEMworks.

Peter did realize the significance and importance of scientific reputation and credibility. Our own Mario Capecchi had received the Nobel Prize two

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years earlier. I knew that and had met Mario, but as I wasn't especially interested in Genetics or 'knock-out' mice, I didn't think of asking him to be involved with The Leo. Peter did. I enthusiastically agreed to his idea of inviting Mario to be the senior science advisor to The Leo. We didn't know then that Mario, who was born in Verona and was a street 'urchin' in Northern Italy during the early days of WWII, was a strong fan of Leonardo da Vinci! He accepted Peter's invitation and worked to help him and the team bring the dream of The Leo to reality.

USCF merged with The Leonardo on July 1, 2009 via an Acquisition Agreement signed by all parties. USCF accounts and assets were all transferred to The Leonardo – including several hundred thousand dollars, as I recall. I resigned as Chair and Director of USCF to facilitate close-out paperwork and termination of USCF as an entity, a foundation, and a 501c3 organization. Mike Keene, Vice Chair of the USCF Board, assumed the Acting Chairmanship of USCF during the termination process. I accepted the position of Science Advisor/Special Projects for The Leonardo. USC staff, payroll, LOW-s, and other USC programs became the responsibility of The Leonardo. SLVSEF was transferred to the UU. The USCF's assets, people, and experience provided a strong science foundation for The Leonardo.

Peter kept his focus on Opening The Leo. He insisted on minimizing all activities not directly focused on that goal. That included our The Big Picture work and the ceasing of all consultant activity. I receded into the background.

I was getting interested and involved with speaking at the Utah Legislature's committees related to climate change and environmental issues. Also, as I began phased retirement from the UU already in 2006, I was planning to get even more involved and active – so it was likely politically wise for The Leo to have me well in the background.

Barbara and I celebrated the merger with a large staff and supporter party at our home on July 2, 2009. Although I no longer had any direct responsibilities for The Leonardo or any of the programs transferred to it after the merger, I continued to be close to Peter Giles, Alex Hesse, and many Board members – providing advice when requested as well as regular unrequested advice, input and critique as well. The USCF formal Articles of Dissolution were approved by the State of Utah on Jan. 6, 2010.

## Dennis Evans

In 2010 The Leo moved from its partially pro-bono offices in downtown SLC to a space adjacent to Exchange Place. It was there that Dennis Evans died on Oct. 25, 2010, working at his desk, apparently of a heart attack. His constant cigar and his handy Scotch were not there. He had heart issues and had suffered a milder attack some 7 months earlier. But doctors and therapy were not for him. He was a quiet, friendly, unassuming man, with the reputation of simply getting things done. We were impressed with ‘Dennis’ boys’, young men that he would hire on a job to job basis to move, build, modify, fix, and otherwise ‘get things done’. He must have given them good instructions and guidance, because the things done were generally done well, quickly, and inexpensively – and perhaps without formal authorization or strict adherence to Code.

Dennis’ funeral services were handled by his semi-estranged family. The services were on Oct. 29 at a Mormon chapel. I was so annoyed at the Mormonness of the service that I wrote notes on my ubiquitous pocket pad, with which to develop a later essay, perhaps to be titled *On A Mormon Funeral*. I had been reading a lot about Mark Twain and wondered what he’d write about such a funeral, considering his early remarks on The Church – and on Brigham Young and his wives – in *Roughing It*. Twain viewed *The Book of Mormon* as ‘chloroform in print.’ I’m sure Dennis would have agreed. Dennis was a very ex-Mormon, a bit estranged from his very Mormon family, who organized and conducted the service. Nearly all The Leo staff were present, of course. The remarks at the service were largely Mormon flowery pabulum, typical of the few other Mormon services I had attended. One of the speakers said Dennis was ‘complex’. His son mentioned his teen-age journals and mission service. Nothing was noted about his adult life, his post-Mormon life, how his Finnish mission and travels in Europe changed him or his work on The Leo. I really wanted to insert a small bottle of Scotch – and some cigars and matches – into the coffin, to keep him company.

His death, and our earlier experience with BodyWorlds, did catalyze a lot of thinking around Death – and Life. We brainstormed exhibits for The Leo on Death. I recall a flight with the Gyroscope folks, Les Kelen, and probably Mary

Tull when we discussed exhibits around Death, probably stimulated by a visit to the Minnesota History Museum and its 'If These Walls Could Talk' exhibit.

Dennis' death was a major blow to the project, as he was coordinating and managing the building remodeling and upgrading, preparing for the planned opening of The Leonardo almost exactly one year later.

## Opening to Operation

Alexandra, Peter and the rest of the staff succeeded – managing to open The Leonardo on Oct. 8, 2011. Alleluia!

This was almost exactly 18 years after Bob Olpin and I discussed his Leonardo Doodles during Ray Kingston's inaugural meeting of the Utah Science-Arts Center Advisory Board. And it was about 25 years since our original science center discussions of 1986!

The Leo had to borrow funds from SLC to be able to open, leaving the project with a debt liability from Day 1. Peter Giles resumed his retirement some months after opening, leaving Alex with the Herculean task of somehow keeping The Leo open and afloat. When Peter accepted the challenge to work to open The Leonardo, he had made it clear that he would get it open, but not stay on to run it. And that's what he did.

The Leo had its disagreements and moments with the City for many years, through the administrations of Rocky Anderson, Ralph Becker, Jacque Biskupski, and now Erin Mendenhall.

The Board needed reinvigorating some years later. Fortunately Dinesh Patel came on board and served as Chair. He and Alex have worked hard to put The Leo on firmer technical and financial footing. Several years later Lisa Davis assumed the chairmanship of the Board. I rejoined the Board in 2018, after being off the Board since 2007. I worked to try to assist in fundraising, by connecting old colleagues and earlier donors to The Leo staff, especially the development people. Noting the success of the new Flight! exhibit, I reconnected with Tyler MacCready to learn if the Aerovironment firm his father founded still had the 6 ft da Vinci-based glider that he showed at The Leo's original Flight! event in

2005. They did, and they gave it to us. Barb and I retrieved it from Aero's Simi Valley site on a visit to friends in north Los Angeles in Feb. 2019.

## The da Vinci Award

The Leo instituted a Gala and a da Vinci Award in May, 2019 – on the 500th anniversary of Leonardo's death. The plan was to identify an individual worthy of the prestigious award, as well as to bring attention and support to The Leonardo. I strongly advocated for Stephen Jacobsen, who unfortunately had died of an abrupt heart attack several years earlier. We really wanted the prize to go to a living person. But the case for Jacobsen was very strong. His family and coworkers were very pleased, and the family foundation provided modest support.

Stephen had been honored with the ASME Leonardo da Vinci Award two decades earlier. Steve was a great fan of da Vinci. He and I had discussed Leonardo, as well as science and engineering, over the years. He was also a colleague, a contemporary, and a collaborator with Willem Kolff. He was an entrepreneur, and he was known by many as the closest thing we had to a modern, practicing Leonardo. In about 2008 I gave him a copy of Mario Taddei's then newly published *Leonardo's Robots* book. Later we arranged a tour with Giles and Hesse of Sarcos, Steve's robotics firm.

I worked hard to connect to and contact his earlier coworkers, students, and colleagues, including the Jacobsen Family Foundation, Steve's son and daughter, and John McCullough and Wayco Scroggins with Jacobsen Innovations (Steve's last company, which had been called Sterling Technologies until his death).

They all provided materials, demos, quotes, sketches, access to video and related materials for an award video we showed during the event. Mario Capecchi spoke to the crowd about Leonardo and The Leo. One of Steve's iconic man-size robots was displayed, thanks to Wayco. We noted Steve's interest in da Vinci, in creative education, and in solving problems.

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The 2020 awardee was Chris Johnson, cofounder of the uu Scientific Computing Institute (sci). He, too, is a fan of Leonardo, and has made his own incredible contributions to scientific and technical visualization. His award was made at a virtual (on line) gala event due to the COVID-19 pandemic. The event video is online at: <https://secure.qgiv.com/event/leonardogala/>.

Speakers included David Pershing, former President and Engineering Dean, uu, and Ruth Watkins, the then President of the University.

The Leonardo was planning its 2021 gala and award presentation, to coincide with the 10th anniversary of its 2011 opening: Oct. 8, 2021. Mario Taddei was engaged to assist with Flight! and related exhibits and activities to celebrate the 10th anniversary. But that was all postponed due to continuing COVID concerns.

The 2021–22 Leonardo Awardee was Nalini Nadkarni, uu Professor of Biology. Often called ‘A Force of Nature’, she gave a wonderful, inspiring, spirit of Leonardo talk one day before Leonardo’s 570th birthday, April 14, 2022, at a small event at The Leonardo. The unedited video is available at <https://www.dropbox.com/s/vn1el12880j6849/Nadkarni%20Leonardo%20Award%204-14-2022.mov?dl=0>.

The Leonardo is now working closely with a number of community organizations, including Artes de Mexico, the Black Chamber of Commerce, and Ken Sander’s Rare Books. The new City Council and current Mayor now seem to be far more supportive.

I resigned from The Leonardo Board on Dec. 1, 2022, citing my limited time and need to focus on ongoing book projects, though I plan to continue to be supportive and helpful as time, health, and longevity permit.



## Science Centres on the Road – Places, People, Perspectives

Nearly all large cities have science museums or centres. Most belong to the us-based Association of Science and Technology Centers (ASTC) and to the European Collaborative for Science, Industry, and Technology Exhibitions (ECSITE) – now commonly called the European Network of Science Centres and Museums. Many also belong to the American Association of Museums (AAM) and other groups. These groups hold conferences, workshops, exhibitions, and generally lobby for and support science museums and centers. In addition there are associations for planetaria, aquaria, and natural history museums. I considered and used many of them – and joined both ASTC and ECSITE – for some years.

I don't recall when I first became interested in science centers. My first experience was probably The Exploratorium, and I was likely already in college at the time. My interests in science education naturally led me to interactive, hands-on, exploratory learning and teaching. Once I realized what a remarkable resource they were, I became irreversibly hooked.

For two decades, roughly 1990 to about 2010, I traveled a great deal – and visited science centers and centres whenever and wherever I could. These were the years of planning for and development of The Leonardo. All the facilities I visited during those busy years have been greatly changed and might be unrecognizable to me today (8–4–2022). Many were moved. Some were replaced by larger, more 'modern' facilities, including some funded via national lottery-derived funds. Many of the centers I did visit stay with me, providing perspectives and memories which last to this day:

The 'hands-on', interactive science center philosophy was developed and became known and popular with the opening of San Francisco's unique Exploratorium and Toronto's Ontario Science Centre – in 1969. Those two institutions stimulated and catalyzed the development of similar facilities all over the world. They were so very different from the 'hands-off' displays available in

traditional natural history and art museums. Kids and parents both loved to ‘interact’ with and actively participate in the ‘exhibits’. They stimulated questioning, discovery, creativity. They fostered critical thinking and problem solving. They explored reality. Leonardo da Vinci would have loved them.

The Exploratorium in San Francisco served as the catalyst and model for the science center movement in the USA. Frank Oppenheimer was a popular and effective physics professor at the U of Colorado. Earlier, at the U of Minnesota, he was barred from teaching due to the Communists in Government paranoia spawned and pursued by Senator Joseph McCarthy. Frank was the younger brother of J Robert Oppenheimer, director of the Los Alamos National Lab and one of the ‘fathers’ of the atomic bomb. Frank was also a nuclear physicist. When Robert argued against the further development of atomic weapons, he was accused of communist sympathies during the reverberations of the McCarthy era. Frank was caught in that paranoid morass.

Science writer KC Cole provides a great perspective on the genesis and development of science centers via her *Something Incredibly Wonderful Happens: Frank Oppenheimer and his Astonishing Exploratorium*, a biography published in 2009. In his Foreword to the book, Nobelist Murray Gell-Mann quotes Lucretius:

‘As children in blank darkness tremble and start at everything, so we in broad daylight are oppressed at times by fears as baseless as those horrors which children imagine coming upon them in the dark. This dread and darkness of mind cannot be dispelled by sunbeams, the shining shaft of day, but only by an understanding of the outward form and inner workings of nature.’

Lucretius wrote that in 55 BC! – 1500 years before da Vinci and 2000 years before *A Nation at Risk!*

Frank Oppenheimer had a dream for an interactive, personal discovery focused, science museum. He published *Rationale for a Science Museum* in 1968, thanks to the encouragement of *San Francisco Chronicle* reporter Herb Caen. They worked to acquire, from the City of San Francisco, the somewhat derelict Palace of Fine Arts, near the Golden Gate Bridge. They transformed the unique open building into a huge laboratory with which to make all visitors curious via direct involvement and participation. The best description of the Exploratorium-Oppenheimer philosophy and goals is Chapter 1 of Cole’s

biography, titled *The Palace of Delights*. The ‘museum’ ‘opened’ without fanfare in late 1969 – no admission charge!

Later, with the staff of The Exploratorium, Frank published *Working Prototypes*, 1986. The three volume *Exploratorium Cookbook* became available in the early 90s – basically a ‘cookbook’ for building an Exploratorium-based science center. The documents provided full details on the design, construction, and implementation of hands-on discovery exhibits for the general public.

The Exploratorium also had a strong arts and artists component, including various artists in residence programs. One of the purposes of art is to trigger emotions, responses, curiosity, questions – very complementary to science.

I never met Frank Oppenheimer – he died of cancer in 1985. The Exploratorium continues to be both a legend and a model for interactive, discovery-based learning and ‘education’ – and the fostering of critical thinking.

Something similar and yet very different was happening in the Toronto area at about the same time. The Province of Ontario planned and built the Ontario Science Centre very near Toronto – to help celebrate Canada’s Centennial. The Province engaged a young local architect Ray Moriyama – it was his first large project. He was one of the many Japanese-Americans interned in a concentration camp during WWII. His focus was on (via Wikipedia) ‘humane architecture with the pursuit of true ideals, democracy, and unanimity of all people’. I don’t know the story of the Moriyama-Miake connection, if there was one.

Taizo Miake, also Japanese American, is a cultural anthropologist of sorts with interests and ideas related to crafts, indigenous cultures, and critical thinking. Taizo Miake had many ideas on effective audience engagement using art, theatre and hands on activities – tactile and experiential learning. Taizo had a major influence on the development and implementation of the Ontario Science Centre (osc). As noted earlier in this chapter, Taizo and The Leonardo architect Ray Kingston connected and bonded in early 1993. Robert (Bob) Johnson and I also connected closely with Taizo.

Although I had visited several science centers earlier, my real science centre experience and ‘education’ likely began in June, 1993, when Barbara and I visited the Ontario Science Centre, talking with its then management and some of the staff. We also visited the IMAX 3-D theatre firm in nearby Hamilton, then drove up to Sudbury to visit Science North and Taizo Miake and his artist wife,

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Ann Suzuki. Taizo told us he helped with the Sudbury project to implement some of his ideas that were not utilized in the Toronto Centre.

Looking back, I recall both the Toronto and Sudbury facilities had an emphasis on crafts, cultures, community-volunteer projects, and group as well as individual engagement. Science North had very few staff offices. The staff were on the floor, engaging with the visitors. They had small desks and bookshelves right adjacent to the exhibits and activities for which they were largely responsible.

Later that same year I experienced the Science Museum of Minnesota, in St. Paul, the first of several visits. I began to appreciate the qualities and characteristics of facilities which did indeed engage with visitors. These were not museums in any traditional sense – they were basically laboratories.

1993 also brought an invitation to participate in a workshop on ‘Intelligent’ Polymers in Woolongong, Australia, south of Sydney, thanks to a collaborator of Sung Wan Kim, Gordon Wallace. He’d organized an Asia-Pacific Workshop on Intelligent Materials, held Nov. 1993. My talk was titled: All ‘Polymers are ‘Intelligent’: Polymer Surface Dynamics’. While there, I visited Woolongong’s then small Science Centre, now called ScienceSpace, developed and run by Glen Moore. It had opened in 1989, inspired in part by Questacon, Australia’s National Science and Technology Centre in Canberra.

While touring the hands on exhibits with Moore, he introduced me to Mike Gore, the founder and director of Questacon, who just happened to be visiting! What luck. The three of us talked and planned and connected. Mike would be driving back to Canberra in a few days, and offered me a ride home with him – he’d give me a private tour of Questacon, which he founded and opened in 1988. I changed my plans slightly, and rode with Mike into the Australian ‘interior’ to its famous Capitol City. Mike was quite a showman, putting on interactive ‘lectures’ as Galileo, at Questacon. Interactive theatre is always engaging, as Taizo often pointed out. I think this was where I first saw staffers assembling to do spontaneous ‘shows’ on the floor – unscheduled. The nearby visitors would flock to the mini-performance. After 5 minutes or so the ‘spontaneous’ show or demo would be over.

Mike had visited the Exploratorium in late 1975 and became hooked, returning to Australia to develop a science centre. He opened a small facility in Canberra, called Questacon. The Australian Bicentennial Commission chose

to expand it to become the Australian National Science Centre (ANSC) in 1988. Questacon included a program called Science Circus, which rolled a hands on mini-science centre experience throughout rural and outback Australia. And I thought Utah was largely rural!

Just before I had to leave, Mike took me to a nearby park overlooking Canberra, but the promised kangaroos never appeared.

Then I flew from Canberra to Sydney and a visit to the Powerhouse Museum. Then it was on to Auckland and a one week introduction to New Zealand's North Island. Shortly after arriving and asking around, I learned that there had been a recent national plan, using lottery-derived funds, to develop small science centers throughout the country. New Zealand already had a well known and respected science centre in Christchurch, on the South Island, which I didn't have the time to visit. I drove, British style!, from Auckland to Wellington, seeing several new and developing science centres along the way.

A major reason for my visiting New Zealand was to experience bioluminescence, especially the glow-worms hanging in caves. The highlight of the trip was looking up while sitting in a large inner tube tied to a string of others – gently 'black water rafting' through a black cave – black except for the millions of 'stars' on its ceiling produced by self-tethered glow-worms. Truly amazing!

During much of the mid-90s I was traveling under Whitaker Foundation and Smith & Nephew sponsorship. I was in London in Sept. 1994 for s&n. Aaron was working at WHO in Geneva at the time. So we met in London, sharing a room at the plush Churchill Hotel. After exploring a bit of London and a pub or two we trained to Cardiff via Bristol, of course. I had heard of Richard Gregory and his Exploratory, near the Bristol train station. Gregory was very well known for his work on the physiology of vision and his book *Eye and Brain*. He had visited the Exploratorium, and was inspired to do something similar in Bristol – hence the Exploratory. It was Gregory who encouraged Oppenheimer to include exhibits and activities related to sensory physiology. Gregory was quite a character and speaker.

A memorable Gregory quote:

"Facts are fossil remains of sometimes ancient questions... and new questions can generate [future] facts and understandings... Questions are probes and hooks for exploring..."

While working to establish the Exploratory, he also noted:

“We also learned, when chatting with business people, that whiskey, rather than sherry, works the magic of transmuting dreams into gold... and serve the interests of Exploratory thinking.”

Gregory’s little 1986 book, *Hands-On Science – An Intro to the Bristol Exploratory* summarizes its working philosophy and activities.

Aaron and I were especially impressed by the Exploratory’s Stradivarium – an installation/exhibit for hands on music and sound. Developed and operated by a Chris Challen, it featured a huge, walk-in guitar with massive strings, a musical ‘abacus’, Chaldni plates, and other experiences. Challen was a wonderful guide and facilitator. Very impressive. I was also impressed by several electrochemical exhibits, because they are often somewhat difficult to operate and maintain. Gregory’s neuroscience interests were clearly evident.

We had to cut short our visit due to train schedules and my s&n commitments in Cardiff. We trained on to Cardiff, I checked in for one night in a local hotel, Aaron and I went to the local Hard Rock Cafe and talked. He thought he’d make better use of his limited time in London rather than Cardiff, so back he went to our spacious Churchill room in London. I did my Cardiff duties and also visited Techniquet, the Cardiff-Wales Science Centre, founded and led by a very charismatic John Beetlestone. It was Exploratorium-like and – light, very colorful, designed more for younger primary age children.

I was also working for the Swedish government at the time, on several research project evaluation and assessment committees. The Swedish connection came via our own resident Swede, Karin Caldwell. She was on the Bioengineering faculty from the mid-80s through the mid-90s, cofounding and managing the Center for Biopolymers at Interfaces (CBI), one of the state’s very first Centers of Excellence. She also chaired the Dept. of Bioengineering for a term, before returning to her native U of Uppsala to accept an endowed chair. Karin was well known and respected in the Swedish science and engineering community, worked closely with several Swedish companies, and had served as the Swedish Honorary Consulate in Salt Lake City.

On one trip to Sweden, I routed via Copenhagen to Malmo, then on to Lund, Linkoping, Goteborg, and, of course, Stockholm. One time I stayed in Copenhagen for a day or so, in part to visit their Experimentarium, a near downtown science centre. The activities I recall most clearly related to images which incite strong emotions and perceptions. There was a galvanic skin response

(GSR) activity which recorded your GSR as you looked at various difficult and/or provocative images – some of which would be considered pornographic (rather than artistic) in the USA's antiquated legal and moralistic cultures. GSR is also used to gauge responses in lie 'detection' instruments. That may have been the place where you could view and purchase a large poster of penis closeup images. Talk about diversity!

When in Stockholm one time I took a short commuter flight to Helsinki's Vantaa airport to visit the nearby Huereka Science Centre, which had opened in 1989. Its then Director, Per-Edvin Persson, was well known and highly regarded in the science center world. He directed and represented Heureka from 1991–2013. I wanted to know what was unique there. I was greatly influenced by activities related to language and communication, building upon the uniqueness of Finnish and the cultural history of Finland. I was only there for a few hours before returning to Stockholm – it was well worth the visit. I came back excited about language and communication exhibits for The Leonardo.

A later visit to London for s&n enabled me to see the new Bristol Science Centre, named @Bristol with the slogan We the Curious. Funded by UK lottery funds, it was huge. It included a large climate-controlled botanical centre, multiple floors, and many topics. It was comprehensive and effective, but the Exploratorium-like feel and atmosphere of Richard Gregory's Exploratory was gone. I then flew up to Glasgow, to experience their new lottery funded centre – the Glasgow Science Centre (GSC), which opened in 2001. That, too, was a very short trip, returning to London the same day. GSC had a signature Titanium-clad dome structure.

I did talk with staff in Bristol and Glasgow, who were concerned about financial stability at that time. Lottery funds are great to build structures and monuments, but not for operational or maintenance costs. All science centres suffer from funding constraints and indeed have to compete to some extent with the public education systems and lobbies for even modest public support.

Barb and I visited Paris several times. One time I metroed out of Paris to the Parc de la Villette, which contained Cite des Sciences, a major science and technology center, opened in 1979. When I visited, late 80s or early 90s, there were major exhibits on sustainability and the environment. Barb and I visited together the more downtown Palais de la Découverte, which had an array of

hands-on exhibits. One of its directors, Brigitte Zana served on an early The Leo Advisory Board.

During a later trip through Brussels we traveled out to Mechelen to see the Flemish Science Center – Technopolis. Mainly built for public school groups, I recall unique, effective activities related to rivers, lakes, tides, sea levels, and locks. It opened in 2000, with a focus on biotech and microelectronics.

The Science Museum of London and the Victoria and Albert Museum were sites Barbara and I visited several times during our travels. The Science Museum did have a very well done Exploratorium-like science activity section (Launch Pad) targeted to primary age groups. I also visited the lab and firm of Steven Pizzey on a London visit. Steven's shop, Science Projects, Ltd., was well known for very creative, effective, and robust exhibits for clients around the world. Earlier he'd worked at the London Science Museum and helped develop Bristol's Exploratory. Steven compiled a book on Interactive Science Centers in 1987, with chapters on most of the science centres of that time.

I learned of another fascinating, creative science exhibit developer who worked near Manchester, an airport used often for my s&n responsibilities. I met Ian Russell, Interactive Science UK, Ltd. at the Manchester airport. We had a long stimulating discussion.

Both Ian Russel and Steve Pizzey were participants, via Skype, in a session I ran at the 2010 Hawaii ASTC meeting, titled Flexhibits, Community Events, and Facilitated Involvement. The very well attended session included presentation and discussion of our many activities for The Leonardo.

One time in Barcelona, on the way to see the Kopps in Majorca, we visited the Science Museum of Barcelona, which closed in 1998 shortly after our visit! It reopened in 2004 as CosmoCaixa Barcelona. I wanted to visit as I'd heard a very inspiring talk by its Director, Jorge Wagensburg – at the Portland ASTC meeting in 1994, hosted by OMSI, the Oregon Museum of Science and Industry. I recall his emphasis on marine science and biology, including living animal and plant 'please touch!' activities, now common in marine aquaria. His Barcelona museum had a remote camera system on the nearby coast allowing visitors to see marine animals in real time. Wagensberg was a serious scientist, working in thermodynamics and theoretical biology; he also served as a president of ECSITE.



I recall that same Portland ASTC meeting included a keynote talk by a very pregnant Alison Gopnick titled *Children as Scientists, Scientists as Children*. It was very important to my initial ideas and thoughts on science learning through experience. Chapter 2 in *Science without Walls* highlights a toddler named Elisabeth who was learning science by (chaotically and unknowingly) doing science. Gopnick went on to give other talks, such as the 2001 AAAS meeting: *The Scientist in the Crib*, as well as produce several books on the subject. Much, much later, as a grandmother, she talked with Michael Pollan about the open mindedness of little children as analagous to what psychedelics might facilitate in close-minded adults.

Barb and I visited the California Science Center (CSC) in Los Angeles one afternoon, as hordes of USC (Univ Southern Calif.) Trojan fans streamed in the opposite direction to a football game. We were in LA as a guest of Don Szabo and HB Stubbs, who were interested in working on *The Leonardo*. CSC was in an expansion mode. It was a very informative and entertaining visit.

I also visited the Pacific Science Center in Seattle and Science World, the Vancouver (Canada) Centre, on one of several trips to the NW. I talked with management after experiencing the exhibits, as I wanted to learn all I could about planning, building, directing, managing, funding, and sustaining a science centre.

I had arranged to meet and talk with Geoffrey Ballard at Science World. After working on developing rechargeable Lithium batteries, with the goal of making electric cars practical, Ballard moved into the area of fuel cells in the late 80s, early 90s, thanks to Federal grants. He rapidly became an expert and pioneer in fuel cells, including delivering a hydrogen-powered fuel cell electric bus for the City of Vancouver in late 1989. The fuel cell technologies developed rapidly in the 90s. Ballard Hydrogen was founded in 2000. He was one of the early visionaries on the hydrogen economy. I wanted to meet him because I was convinced that a hydrogen-based energy economy was in the best interests of humanity and its planet – and wanted to develop exhibits and activities for *The Leonardo*. We had a great discussion. He directed me to some German firms developing teaching aids and kits on hydrogen, fuel cells, and integrated energy systems.

From his Wikipedia profile: He told *Discover Magazine* in a 2002 interview that

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‘My goal from the very beginning was replacing the internal combustion engine – just getting that off the streets.’

As I write this in Sept. 2022, the Federal government is in the process of issuing major grants for hydrogen energy centers, including a storage project in Delta, Utah, using the very salt caverns I included in the Energy part of my political platform in 2012 (Chapter 12).

Geoffrey Ballard died in 2008 at 75 years of age, about two decades too soon.

One time in Philadelphia I walked over to the Franklin Institute Science Museum, which was unique in some of its activities related to the early days of electricity – and Ben Franklin’s pioneering work. It is probably the oldest science museum in the USA.

I never did get to the Bakken Museum in Minneapolis, dedicated to the history of electricity and magnetism (E&M). Earl Bakken invented the pacemaker and, in 1949, founded the company which later became Medtronic. Bakken died in 2018. I tried to get Medtronic, and even Bakken himself, interested in funding E&M activities at The Leonardo. No success. The Bakken Museum developed a good website and online book shop, with a range of booklets on novel, effective E&M exhibits and activities. The USC-TheLeo folks were very interested in developing activities ON You, the Visitor! We were interested in titles like The Body Electric, YOU are the Exhibit, ECG, and even EEG. We wanted to cover the range of bioelectricity sensing, stimulation, and curiosity.

The Hansen Planetarium used to do electric energy demos based on the activities and showmanship of Nikola Tesla. One of their physics demonstrators, Jayceen Craven-Walker, would work with Tesla coils and van der Graf generators to do a human electrical object lightning show. Sparks would fly, her long hair would extend straight out – she would literally sparkle. Jayceen later worked with us on the USC and LOW.

In the New York City area I visited the NY Hall of Science, near La Guardia airport, as well as the then new Liberty Science Center, in Jersey City, New Jersey – with its clear view of the Statue of Liberty and easy access to Newark Airport. The husband and wife Gyroscope team met at and helped develop the Liberty facility long before they founded Gyroscope and were hired to help develop The Leonardo.

Once in the Research Triangle area, perhaps on a seminar visit to Duke University, I visited the Museum of Life and Science in Durham, partly because I knew that the Duke zoologist Steven Vogel had worked with them on exhibits related to his work and books. I'd been very impressed by Vogel's writings. His book, *Life's Devices*, was one of the texts for a graduate course I offered in Spring, 1997 called From Biology to Engineering. I had obtained, gratis, different college freshman textbooks on Biology. Each was nearly 1000 pages, very well illustrated, covering the entire field of biology – beautiful and massive books. The students and I flipped through the books looking for phenomena and examples in Biology which might make for interesting practical engineering projects. Fascinating! Vogel visited the TU and gave a talk in 1994. He had a reputation for doing great science on almost no budget – hence ideal for a fledgling science center. Steve Vogel died in late 2015.

Visiting Columbus, Ohio in 2001 or 2002, probably for a gig at Battelle Memorial Institute (BMI), Tonio and I met at COSI – Columbus' Center of Science and Industry. It was a very large facility. We walked through it fairly quickly. I had visited and studied so many science centers that it was easy for me to walk by exhibits and activities I had seen elsewhere, unless they were particularly unique or innovative. COSI also had an outdoor exhibits area, with large basic physics installations: levers, pulleys, big mass objects. Very effective. Kids, especially boys, love mass – big trucks, tractors, construction equipment.

Standing on an upper floor section which surrounded a large foyer on the floor below, I gazed across the building to the opposite wall. I noticed a very large 'photo' of Einstein. I don't think there was a viewing telescope (there should have been), but we quickly realized that Einstein was made up of thousands of images ('pixels'), shots of COSI visitors in action. Such a personalized photomosaic is an excellent way to capture the attention of visitors and donors.

It reminded me of the children's *Where's Waldo* books – a British puzzle series which effectively teaches close seeing of images and details. Da Vinci was always scanning – it's a great skill to cultivate. I came home, purchased an inexpensive photomosaic software program and made some images of my own using some of my own photos.

Another gig, in St. Louis, perhaps at Washington Univ., enabled me to visit the St. Louis Science Center (SLSC). It was sited on one side of Interstate 64, with a bridge over I-64 to Forest Park, a very large public park with a lake

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and the well known James S. McDonnell Planetarium (of McDonnell Aircraft fame), as well as other attractions. I walked the enclosed bridge over I-64, watching the traffic whizz below me in both directions. There were several, maybe more, small stations on the bridge containing attached, rotatable radar guns. So cool! Anyone could point the gun and measure the velocity of vehicles as they approached or receded from the viewer. There was of course content in basic physics, traffic safety, breaking the law via speeding, as well as the physics of radar and its applications. I went home and bought a cheap radar gun from a science products catalog.

Visits to Washington, D.C. allowed me to visit the Smithsonian Museums, especially the Air and Space Museum. The highlight for me was a small Piper or Cessna aircraft on a pedestal with a ladder into the open cockpit. Visitors could climb in and move pedals and stick (the device used to turn and otherwise navigate the plane). Very effective – made me want to resume those old flying lessons.

One time, probably related to a visit to ONR (Office of Naval Research), a major Federal funding source for scientific research, I visited the nearby Newseum, a presentation and recognition of journalism, journalists, and the importance of free speech. Later the Newseum built a new and expanded museum in downtown DC, which was also inspiring and informative. Another cool DC museum was the International Spy Museum, a private attraction. I loved it. There was even an exhibit related to what the kids and I had seen adjacent to the Berlin Wall back in the late 80s. All the ‘secret’ James Bond-like spy gear was there. I purchased several foldable fake key devices, which contained a tiny saw, awl, blade, screwdriver, and perhaps scissors – all folding flat to look just like a metal key – sort of a flat tiny Swiss Army Knife. It went with me almost everywhere after 9/11 resulted in all the enhanced homeland security screening. Some 15 years later it wouldn’t work as the screening technology became too sensitive for it.

The science center community had an information source for traveling and for sale exhibits. Max West’s Informal Science Review was well known among the ASTC community and was generally up to date on its listings and descriptions.

In the early 90s I visited DC often for Whitaker Foundation meetings, but also to participate in AIMBE functions (the American Institute for Medical and

Biological Engineering), the brainchild of Robert Nerem and several other respected bioengineers. They felt that our interdisciplinary field needed exposure, awareness, and representation in the Capitol. So AIMBE was established in the very early 90s and held an annual meeting in the NAS Building, located on the National Mall. Connection to the NAS and its iconic building, with a great statue of Einstein near its front entrance, immediately gave AIMBE the exposure and prestige connected with the NAS, as well as the related National Academy of Engineering (NAE), and Institute of Medicine. (IOM). The small NAS building contained small historical exhibits and a display of the hundreds on NAS/NAE/IOM reports commissioned by Congress and others to provide scientific analysis and advice to the US Government, including Congress, the President, and Federal agencies.

From 1974 to 1995 an Office of Technology Assessment (OTA) provided congressional members and committees with objective and authoritative analysis of the complex scientific and technical issues of the late 20th century. Around 1990 via the Reagan and GHW Bush administrations, it became clear that the Republican Party was indeed waging a ‘war on science’. OTA was ‘defunded’ at the end of 1995, following the 1994 mid-term elections which led to Republican control of the Senate and the House. House Republican legislators, led by Newt Gingrich, characterized the OTA as wasteful and hostile to GOP ‘interests’.

This action opened the door to largely GOP-funded lobbyists and ‘advisors’ providing most of the science or technical ‘information’ to Congressional staffers, whose numbers had also been cut. Thus unbiased knowledge about science and technology was largely eliminated. The NAS and most other science and technical organizations were appalled. With the election of George W. Bush in 2000, *the Republican War on Science* (the title of a 2005 book by Chris Mooney) was in full swing. NAS felt it needed to act. Thanks to resources provided by its former president, UC-Berkeley biochemist Daniel Koshland, the Mariam Koshland Science Museum was endowed and established in downtown D.C., specifically to provide science exposure and experience to the DC government community. It was located three blocks from the Mall and very near the Spy Museum. Via Wikipedia: The Koshland Museum was centered around two primary exhibits: “Earth Lab”, which focused on issues related to climate change, and “Life Lab”, which emphasized learning, aging, nutrition,

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and infectious disease. The museum also had a “Wonders of Science” section devoted to interactive exhibits and information on the NAS/NAE/IOM and their many objective reports.

The Koshland opened in early 2004. The NAS’ Patrice Legro served as Director. I learned shortly after it opened that a Tom Bowman had major responsibility for its exhibits and content, which interested me greatly. Sometime later I made contact with Tom and he provided oversight and advice to our plans for the Utah Science Center and then The Leonardo. The Koshland had one of the first comprehensive global warming/climate change interactive exhibits and served as a model for other such activities elsewhere. In 2008 the NAS published and widely distributed the booklet *Understanding and Responding to Climate Change: Highlights of National Academies’ Reports*.

The Koshland Science Museum closed in 2017; it was replaced by an on-line NAS program called LabX.

Congress-people and their staffers need science and technology perspectives more than ever – but all they get now are lobbyists with a very biased, focused agenda. Republicans don’t want to confront real reality – they want to believe their own fantasies. Although Obama was a breath of fresh, rational air in 2008, the GOP largely controlled (and funded) Congress and the media during his two terms, largely thwarting his initiatives and plans. And then along came Trump...

Every science centre is somewhat unique, with activities and exhibits derived from the interests and experience of their founders, directors, and staff – even though there is a somewhat ‘standard’ set of ‘basic’ exhibits, most derived from the classic Exploratorium cookbooks.

Each and every visit was ‘new’ to me. We wanted The Leonardo to include the very best of all the science centers. I returned from each visit with new and revised ideas and perspectives.

## Plans and Ideas – so far unused

The Leonardo – and its precursor and complement the Utah Science Center – came up with many ideas and plans, most of which have yet to be implemented or used. Had we real resources and more time...

I offered many courses at UU related to developing exhibits for the USC/TheLeo. Electrical Engineering (EE) and Mechanical Engineering (ME) also included exhibit projects in several of their courses. In 2006 this approach was summarized by Jae Kim, Mike Anderson, and me in a poster at a National Academy of Engineering (NAE) service learning meeting in Washington DC.

A preview of an interactive visitor-focused science center was provided by the Spring 2003 Introduction to Bioengineering II course. I helped the 75 students self-organize into 11 teams, each focused on a bioengineering-based activity, most ON the visitor. The course had a semi-stiff lab fee, \$100 (I think), which we had in a UU account for supplies and expenses. They had some access to my labs and to the UG Bioengineering Teaching Lab. We had four TAs, each assigned to a group of projects.

BioE 1102 in Spring 2002 was also project and team based, focused on Very Personal Chemistry. The topics were:

- Pulse Oximetry
- Water Conductivity
- Anaerobic Energetics
- Bacteria and You
- “Urine’ for a Treat
- Water – pH and Hardness
- Expired Air – Alcohol
- Sweat and Skin
- Expired Air – O<sub>2</sub>/CO<sub>2</sub>
- Aerobic Energetics
- Calorimetry

Some of these projects served as foundations for the Spring 2003 projects.

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The 2003 YOU! are the Exhibit projects were displayed in the Engineering Classroom Building foyer and made available to the campus and general communities. We were 'open' over several days at the end of the Spring term, when the exhibits would be 'manned' and available for measurements ON the visitors. I was very pleased with the students' resourcefulness, output and performance. The exhibits were highly interactive, safe, functional, and very interesting. For the Body Electric EEG exhibit, for example, two of the students involved found that their neighbor had been an EEG tech and had two old units in his garage. They worked! – and were used. Most students borrowed their equipment from professors and graduate students in bioengineering and the medical school.

The Urinalysis exhibit, dealing with pH and glucose detection, was in the nearby men's restroom, set up in one of the toilet stalls. We took turns for women or men to 'use' the exhibit.

The EMG (electromyogram) Team detected muscle electric signals and used their intensity to remote control a little car racetrack competition! The personal EEG was popular, as was a balance activity. There was an exhibit on lung spirometry, another on diabetes, including pinprick blood glucose measurements. There were activities on Body Art via Skin and Tattoos, Oximetry, and a Fuel Cell kit and experiments. We had a body impedance measurement unit provided by a Korean firm. Barb listened to blood flow in her arm via an ultrasound Doppler unit.

## **Risk, Statistics, Numbers – and Paul Slovic**

Journalists and other educators often have to deal with numbers related to risks and fears. In the late 80s I became very interested in ways to facilitate the public's awareness of and understanding of risk, safety, luck, and statistics. These interests likely reawakened during the 1990 course on Critical Science Communication and formed the basis for swow Chapter 37 on Luck and Risk: Personal and Private Statistics. I learned of a classic, seminal 1968 paper by



Chauncy Starr, Social Benefit vs Technological Risk, originally via Noel de Nevers' Technology and Society course back in the 70s.

Jeff Unruh, who was working with me on the Utah Science Center and The Leonardo, was also very interested, together with his father, Jim, on public awareness of numeracy and statistics. Jim and Jeff had a small family foundation which funded a small project we called Choice and Chance – to develop personalized, interactive experiences for Leonardo on Wheels (LOW) and later for the museum.

And, of course, the 9-11-2001 terrorist attack put the topic of terrorism risk on the front pages. It was probably about then that I learned of Paul Slovic and his Decision Research contract firm in Eugene, Oregon. I followed his work, especially from about 2006 on... I read some of his papers, bought and partially read his books: *The Perception of Risk*, 2000; *The Feeling of Risk*, 2010.

It was perhaps through Paul that I became aware of the Society for Risk Analysis (SRA), joined it, attended several conferences. SRA was also interested in public awareness of and appreciation for risk and related topics. I learned that their 2006–7 President, Kimberly Thompson, was a very effective risk communicator. Her cartoon text *Risk in Perspective: Insight and Humor in the Age of Risk Management* was published in 2005. SRA, especially Thompson and Paul Slovic were quite interested in Risk Communication and the potential of exhibits and activities via science centers.

Starting in about 2007 Paul began considering number 'numbing' and the need to personalize or personify risk issues and situations. Paul was speaking and writing on 'Risk as Analysis and Risk as Feelings', focusing on genocide and famine in several parts of the world.

I learned much later that Stalin more or less instituted number numbing with his statement

"The death of one man is a tragedy – a million is a statistic."

At the 2007 SRA meeting I organized a session called Choice and Chance: Engaging the Public. I spoke on Choice and Chance at The Leonardo – the Visitor as Participant; Paul Slovic discussed the Fort Worth Museum of Science's exhibit called Risk!, for which he'd served as a consultant; and Kim Thompson on Risk, Humor, and the SRA – she was its President at the time. There was a lot of discussion.

In 2008 there was good media awareness of *Know Your Chances – Understanding Medical Statistics*, a 2008 book by Woloshin, Schwartz, and

Welch – staff physicians at a Vermont Veterans Administration Medical Center. It took the mystery out of medical statistics, presenting data and results in a dynamic, visual, understandable format. The three authors had been publishing papers related to medical-health risk awareness for several years.

By 2008 we had developed several prototype exhibits for the Leo on Wheels project using the Unruh funding. Luck, Risk, and Uncertainty was a directed two dice throwing exercise to develop a very rough bar graph approximating a distribution. Later we instrumented it as Chances Are... using a random number generator to ‘throw’ the dice, permitting many hundreds of throws, with auto-plotting and display of the resultant distribution. It was very effective.

Chances Are... was included in a mini-Leo on Wheels exhibit in 2008–09 in The Leo building during the Body Worlds exhibition. We also collected visitor close-up photos – with their permission, of course – for use in an exhibit Jae Kim and I were developing with the Utah Labor Commission called Faces of Safety. Each face image became a data point in a distribution of risk data, analogous to the faces photomosaic approach to produce larger images. I immediately saw a way to display the Woloshin, et al. book data as Faces of Health, via the Faces of Safety approach we were already using with the Utah Labor Commission.

Although I wrote and submitted several proposals for exhibits and activities, the only funding we received was modest amounts from the Unruh Family Foundation. The California Science Center, in Los Angeles, did develop an exhibit called Goosebumps – The Science of Fear! I felt it was a bit shallow.

The SRA annual meeting for 2010 was in Salt Lake City. So I worked with Paul to organize a session we called: Engaging General Publics. It included talks and demos by:

Mary Anter and me on ‘Risk and FACES: The Leonardo Approach to Personifying Risk’;

Frank Drews, a UTU Psychology professor on ‘Adolescents and Decisions: Science Centers as Resources; and

Paul Slovic’s ‘The more who die, the less we care: Can we overcome psychophysical numbing through education?’

There were related exhibits in other museums, of course. One I learned about in 2011 was called Interactive Art, at MOMA, New York City’s Museum

of Modern Art. Visitors would simply mark their height on a white wall of the room. After a few thousand visitors, a very cool distribution was obvious.

An early activity which Jae Kim and I developed was Personal and Private Statistics, wherein we measured the height and weight of individual visitors, accumulated the data, and displayed it as a distribution function. We even instrumented it so the distribution was continually updated as additional visitor data was accumulated. One very effective implementation was at a Science at Breakfast event, sponsored by the uu College of Science. I spoke on The Leonardo Project – a summary, update, and request for support and endorsement. Peter Stang, then Dean of Science and coordinator of these events, insisted on rehearsing each speaker – to be sure they made a good impression on the local political and business community from which the College expected support and sponsorship. Stang was a good mentor.

Working with Jeremy Abernathy, an undergraduate assistant in my lab, we set up Personal Statistics at the beginning of the breakfast buffet line, so each participant would be measured before proceeding to obtain her breakfast. The data would immediately be projected on the screen I would use for my presentation. Two data points, then three, then four... they started to get the idea. Soon they were inquiring as to which data was theirs. Some would look at the evolving distributions just before stepping on the platform and then immediately after stepping off to see where their individual data points fell. We measured their weight, via the plate, and height, via a laser device over their head, at the same time. It was a great success. We had some 50 or so participants, resulting in fairly good distributions. We also had a visualizing sound activity, fed from the lecture lectern microphone, so they could see the fluctuating voice frequency distribution as the lecturing progressed.

These two exhibits convinced nearly all that interactive exhibits on you, the Visitor! were effective and interesting. Seoung-Jae Kim did most of the work on Personal Statistics, assisted by Dan Bartholomeusz and Youssef al-Sheikh. We even experimented on collecting face images of the people generating the data and using them to personalize each data point!

Radiation and You was an exhibit on the risks and statistics of exposure to ionizing radiation. From 2004 to 2008 we collaborated with Idaho National Lab in Idaho Springs, and later with Energy Solutions (originally EnviroCare), a local low-level nuclear waste disposal firm. The exhibits used a small Geiger

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counter and a set of small, low background ‘hot’ samples mounted in a ‘Lazy Susan’ geometry. The visitor could compare the counts against various measures and ranges of background radiation. We also dealt with isotopes, nuclear decay statistics, radiation awareness, and Radon in the home. Matt Lentz, a BioE graduate student, helped develop it. Matt is the son of David Lentz, who worked with me in the 70s! The first exhibit we called Radiation around Us – mainly to teach ‘normal’ background levels. An expanded version was called Isotopes, Radiation, and You. Sean Clark developed a very portable version in 2010 as part of our Flexibits project.

I was always looking for novel potential exhibits, especially those which might directly involve the visitor. Having learned about whole body radiation counters, I thought it would be cool to have a walk-in whole body counter at The Leo. How radioactive are you? Eaten a banana in the last few hours? Know about Potassium 40?

I knew such units existed, some at nuclear power stations. After some calls, letters, and emails, I found a retired nuclear engineer in Pleasanton, CA. He may have been with the San Onofre California nuclear power plant (which closed in 2011). He liked the idea of a whole body scanner – and had most of one in his garage! When it was surplused he acquired it, moved the components with some difficulty, to his large garage. Barb was with me. He showed us! He was quite old and it was unlikely he could do anything with it. I’m sure he would have given it to us if I’d asked. But this time prudence prevailed – I knew it was unlikely I’d ever raise the interests and resources needed – even with potential Energy Solutions’ interest and support. Fascinating. But it’s still a good idea. Given all the terrorist ‘detection’ technology developed over the last 20 years, such an activity may be appropriate today.

As I was writing this section in Sept. 2022, I looked up Paul Slovic, as I hadn’t interacted with him for a decade or more. I found the 2015 book by he and his son Scott: *Numbers and Nerves*. It was focused on how to communicate risk and numbers – statistics. They used the terms ‘arithmetic of compassion’ and ‘psychic numbing’ – trying to attach story and image to the unseen and perhaps unseeable. They emphasized the need to personalize the victims of risk – to personalize the numbers. In 2021 Paul received a major prize for his work on: *The More Who Die, the Less We Care*.

Samantha Power thought and said the same thing in her powerful book,

*The Problem from Hell – America and the Age of Genocide, 2013.*

## **MDD – Motion Deficit Disorder – YOU! are the Exhibit**

By about 2004 I became very interested in exercise, metabolism, and motion. There was much interest in the press on obesity, exercise, and caloric intake. I became more interested in my own little belly, posture, and food intake. Very early on Leo on Wheels developed and used a recumbent exercise bike as a human power generator. This was a very popular and common science center activity. The rider would power the pedals, connected to a generator to produce electricity. A load was switched in – generally various lights. To power that load, the rider would have to pedal harder – she had to work harder. We'd switch in filament bulbs and then fluorescent bulbs, and – later – LED bulbs. The lighting efficiency became dramatically obvious to the rider!

There was some media and public interest in 'exercise' at work, on less sitting, on just moving. We played with pedometers. We played with vertical or elevated desks. I started using the term motion deficit disorder (MDD), jokingly calling it a new clinical symptom. I started working standing up and twitching – much of the time.

Due to NASA and the Space Shuttle program, there was interest in low and zero-gravity environments – in Gravity-Deficit Disorder (GDD), though we didn't use that terminology. But I did tie gravity, force, energy, and entropy together in my workshop and inservice courses.

Bruce Houtchens was a local pilot, physician, and telemedicine fan who was very interested in GDD and in the application of bioengineering to pilot and astronaut health. Thanks to him the Bioengineering Department offered a seminar series in early 1990 on Health Maintenance in Remote Environments – related to NASA's interests in missions to the Moon and Mars. He was a great

inspiration, encouraging work in Anesthesiology, Bioengineering, and Medical Informatics. He died at the early age of 57 in 1995.

One of the BioE 1102 freshman students was quite interested in MDD and GDD. She was a bit older than the typical freshman and wanted to be an astronaut, I don't recall her first name, but her last name was Morelli, I think. She was very interested in NASA and in the science center project. She worked on a set of exhibits and activities around the theme of MDD. We wrote and submitted, in fall 2004, a proposal to the RW Johnson Foundation initiative called Active Living.

It was not funded, but did establish a foundation for the Energy and you! exhibit ideas for the usc/TheLeo.

## Nearly Last Thoughts

Most of my ideas and planning related to usc-TheLeo exhibits and programs were summarized at an invited talk at Uppsala University, nearly 20 years ago:

Science 'Teaching' – A 20 Year Perspective, wherein I reviewed the work on *Science without Walls* and the developing Utah Science Center – The Leonardo.

What *really* interests most people? I asked, then answered:

Themselves – *their* body, physiology, activities, hobbies... For teenagers: sex, hormones, acne, AIDS, cars, sports,... For the elderly: health, risk, economics,.. For the not so old (you and me!): safety, medicine, menopause, prostate cancer, breast cancer, sports, gambling, drugs,... For newly marrieds (or unmarried): sex, pregnancy, genetics, diapers, housing, transportation,... For Texans: guns and chili, and oil depletion... For travelers: SARS – today it would be COVID... For Utahns? For Swedes? For *you*?? *you!* *are* the Experiment at The Leonardo/Utah Science Center – the First of the Third Generation Science Centers. I defined First Generation as traditional natural history museums – static and non-interactive; I defined Second Generation as Interactive – *you* control the activity/experiment, like The Exploratorium.

The talk was in Karin Caldwell's Center for Biotechnology, so I expanded upon the role of Bioengineering and Biotech in facilitating personal involvement:

We know how to make measurements on people non-invasively;

We know how to acquire, process, and visualize data;

We can now deal with multi-parametric and even multi-sensory approaches;

We have wonderful visualization and virtual reality tools and technologies;

We can even deal with Complexity.

The incredible array of measurement and analysis tools developed and applied over the last half-century makes possible measurements and experiments which were literally impossible – or incredibly expensive – not so long ago. Bioengineering and Technology make possible the Third Generation Science Center

I argued why waste time talking to – and trying to educate – the 'choir' – we need to get to the (initially) disinterested, uninvolved, apathetic, uneducated. But *how* to reach them? By directly involving them – their height, their weight, their ECG, EMG, EEG; their skin conductance, their breath analysis, their urine analysis, even their blood analysis.

One of our slogans was: 'For adults – and for kids who want to be treated as adults.'

I would also often add: "It's time to treat adults as adults."

We imagined various theme exhibit clusters and zones:

The Training Place – power the building!! (connected to MDD).

Very Private Chemistry – toilet chemistry!

The Body Electric – body surface electricity.

Acoustic Aberrations – where did the music go? My Chances – scaling, risk, luck; Decision Place.

Where's my Train, Bus,? Transit Center.

Who am I? – Genealogy and Genetics. For example, for The Body Electric:

You! are an electricity generating machine, with auras and voltages on your body surfaces.

Put on the electrode gloves – they pick up your ECG signals and transmit them to a nearby computer. The computer uses the signals to produce an image projected on the wall behind you – a computer visualization of your own ECG. See it pulse? Expand and contract?

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Change your ECG signals (by holding your breath, or doing 10 fast knee bends) – the projected image “responds”. Get a little creative! Make that image change by doing more exercise, even dance. The computer can also use your ECG signals to generate sound – ‘music’ you are “composing” – also via EEG, EMG, GSR, etc.

Another example: Energy and You! Fusion (the Sun), photosynthesis, electricity, magnetism, nuclear fission, respiration, fossil fuels, alternative sources, bioenergetics, diabetes, obesity, metabolism. Energy is the most basic concept scientific concept. It is the basis of all physics, all chemistry, all biology – fundamental.

Richard Feynman, one of the greatest physicists of the 20th century, says that if a single word could define the domain of physics, it is Energy. And what single word most defines biology? Most biologists would say: Energy.

We consider basic sedentary living (right now!) – about 1.2 Cal/min (1 Cal=1000 cal);

Minimal Activity requires about 2.6 Cal/min, while walking and physical work require about 4 Cal/min. Bicycling, Dancing, Fast Walking need about 5 Cal/min. I almost always asked anyone within earshot to get up and fidget, please! Overcome MDD. We considered a range of activities to facilitate energy awareness, knowledge, and action.

Cafeteria: Chips to Calorimeter – Measure food energy content via direct calorimetry.

Go to exercise bike – work off that donut! Exercise bike connected to electrical generator – how much electricity can You generate?

We tried to tie it all together – don’t look at Energy as disconnected, isolated. Every switch, light, motor, device will ‘tell’ its energy consumption and inefficiency. There is no escape from the first and second laws of thermodynamics!

I wanted to develop the Hydrogen Connection via generating and using hydrogen, via fuel cells, via direct combustion. I wanted an energy demonstration and education building. I wanted to generate hydrogen directly via bacterial metabolism – Craig Venter’s goal via his Institute for Biological Energy Alternatives.

We wanted to emphasize Energy and Climate. Since the building has an underground parking garage, we envisioned that each car entering or leaving the garage would be sensed, measured, by its CO<sub>2</sub> exhaust and cloud, with the



image of the car and its license plate clearly visible to all visitors! That was barely doable 20 years ago, fairly easy to do today. We could now image methane, even ozone – tie those images into personal choices and behavior, and of course to planetary pathology.

Most of this hasn't happened, yet, but lots of other things have...

Lots of good ideas, almost no money, and time slowly getting shorter (aging).

And I wanted to do other things.

By 2010 The Leo was well on its way to opening.... Onward!



# **Towards Retirement – 2000–2012**

*A New Millennium and Decade • Travels – S&N, Sweden, Portugal,  
Prague, Seoul, London • Teaching • Tonio, Yale, and George Bush – 2001!  
• 9–11 and Beyond • 60 and Counting • 4M Lab, Last Grant – Thanks,  
Dan! • California Events • The Williams • Whitaker Foundation •  
Retirements • Weddings 2004–11 • Erma and Manny • Erma's Story •  
More Manny • Erma in her 90s – and goodbye • Anniversary Travels –  
from 2006 • Technical Transitions • Welcome – Amalia and Manzanita  
• Barb and Fanny Meet • And More Travel • Books, Books, Books! • Still  
More Travel, 2008–2010 • Reunions • 2010 • 2011 was... • Kanab's  
Amazing Earthfest • Stabilizing 949 Mill Creek Way • More 2011  
Adventures • The Leonardo • Barb's Community Garden, 2012... • 50th  
Friendship Party, Wasps, and Real Stories*

## A New Millennium and Decade

**T**HE FIRST DECADE of the 21st Century was busy, productive, and transitional. As the millennium celebration got closer, many people were worried about Y2K, the idea that the second we went from 1999 to 2000, all the world's computers would freeze up. Didn't happen, but lots of worry and anxiety did.

In 2000 and early 2001 my invited seminars focused on Biochemical Individuality and the need for a multi-parameter approach to problems and issues. I was working to challenge the still endemic monoparameter focus of science and medicine.

## Travels – S&N, Sweden, Portugal, Prague, Seoul, London

In February, 2000 it was off for s&n to Cardiff, Wales. While there I took a side trip via train to NW Wales to the village of Powls to see the Centre for Alternative Technology. I didn't have a contact or guide; I'd heard about its vision and operations and just wanted a look. I may have visited on a weekend as it was partially closed – and it was, of course, raining. I did talk with some people. The highlight of the visit, however, was the Centre's gift shop/bookstore, where I stumbled across James Lovelock's new memoir *Homage to Gaia: The Life of an Independent Scientist*, 2000. I devoured it on the train and on my travels back to USA. From Cardiff I made it to Glasgow to see the then new Glasgow Science Centre, an impressive, modernistic Titanium sheeted structure. Then it was to London and on home, via Atlanta to consult with CIBA-Vision.

s&n kept calling! In late April it was back to London for their discussions. I also visited Steve Pizzey and his science exhibits shoppe in London, then to

the ISBC conference in Cambridge, and then to the s&N Wound Management meetings. I stayed at Middlethorpe Hall in York and in Hull. Barb joined me in one of the trips to York and Hull – perhaps this one.

May was a trip to Uppsala, Sweden for an honorary degree, arranged by Karin Caldwell. We were hosted by her and her husband, Dennis, at their wonderful home in Uppsala. Dennis introduced me to the Mozart oboe concertos, we did a short night walk to the North Sea, and enjoyed Uppsala and its surroundings. During the somewhat classical, even pompous, procedures, I had been in line for an hour or more with another degree recipient, a former President of Stanford University, who quipped:

“This shouldn’t be called an ‘unearned’ doctorate – it’s an endured doctorate.”

There were cannons, costumes, music. I was awarded a wreath to wear for the remainder of the festivities. We still have it! Barb was supposed to video my role in the festivities with our very new video camera. She got lots of footage of her feet as she dozed through the rather dull and very long ceremony.

The Uppsala trip included visits to local firms, particularly BIACore, where Malmqvist said kindly:

“...your early work inspired us in the first part of the 80s much more than you are aware of. To understand what surface adsorption of proteins mean and to what extent it could be used in various applications was a true challenge in those days...”

In July we traveled to Lisbon and the Azores with Aaron and Tonio. We flew in to Boston to catch an Air Portugal flight arranged by a Portuguese travel agent in San Jose, Calif. It was the same agency that had arranged Erma’s trip to Madeira with here sister, Mary, back in 1987. We took the water taxi from the Boston dock to the airport. This was one of the few trips where we acquired home video of our adventures, using that cool new video camera Barb had not used in Uppsala!

From Lisbon we flew to Terceira for a few days (Hotel Beira Mar), then on to Fayal. We toured nearby Pico and celebrated Tonio’s birthday in Horta, Fayal. Tonio returned to his studies some 7 days into the trip. The remaining three of us visited more of Fayal, including the volcanic nw corner, the location of the Capelinhos volcano which erupted in 1957–1958. We then flew on to

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Sao Miguel for several days. We saw the Furnas Valley and Sete Cidades on my birthday.

On July 14 we three flew to Paris and then Prague. I was in conferences with Kim where we also celebrated Henry Kopecek's 60th birthday! Aaron and Barb were hosted by Pavla Kopeckova. We all toured castles and landscapes in Bohemia, Moravia, and the Czech countryside. The Kims also participated. I gave a short talk of adventures with Henry and Pavla. We returned to SLC on July 21.

A few days later Aaron routed back to Portland; I routed to Chicago for a Bioengineering World Congress, for presentations related to CRHCT.

Sung Wan Kim's 60th was celebrated August, 2000 on Cheju Island, at the southern tip of South Korea, as a festschrift-like symposium. Barb and I had a great time celebrating Kim and all our coworkers – and recalling Sung Wan's first 15 years at the UTU (the part that I was part of). I gave a short talk titled *sw Kim – The Early Utah Years*. We had special polo shirts and festivities. Koreans really like to honor and recognize their professors and elders. I also talked on *Beyond the Monoparameter Paradigm*. It was a memorable event. On August 22 we traveled home.

In September it was back to s&n in Cardiff, imbibing more local Brains beer and visiting Tony Campbell.

Rob Scheer had accepted a faculty position at Winona State in Minnesota and was busy enhancing engineering education there. I visited in late October, 2000, giving a talk on engineering education via biology.

Around 2000 our sensor work was assisted by a contract with a Japanese firm, Idemitsu, who were developing a CD-based biosensing platform. They were interested in our bioluminescent sensing approach. We'd already considered a centrifugal approach for multi-channel biosensor design and development. Dan Bartholomeusz included a section of his dissertation related to and expanding upon those ideas.

## Teaching

I continued to teach *Science without Walls*, BioE 1510, for the next 12 years, the last time in Spring, 2012.

From 1999–2001 I taught Advanced Biomaterials (BioE 6040) as well as Materials Science 7800, 7801. Materials Science 6001, Biomaterials, Fall 2005, was probably my last MSE course.

I taught Bioengineering 1102, the second quarter/semester freshman core course, from 2000 to 2003. The Spring, 2000 course followed Rick Rabbit's original outline quite closely. Then I added a group projects component to the later offerings:

2001 bioluminescence-based biosensors;

2002 personal chemistry; and

2003 *You are the Exhibit!*

Patrick Kiser was hired in 2002 and 'inherited' the BioE 1102 course, freeing me up to focus more on my interests in public science education and The Leonardo.

Thank you, Patrick.

I continued offering an on demand independent study course, BioE 5020: Interactive Science Projects.

## Tonio, Yale, and George Bush – 2001!

The big event for early 2001 was Tonio's May graduation from Yale – PhD! We attended the Commencement, staying in New Haven with Carl Jaffe, now our friend and technical collaborator. Little George Bush gave the Commencement address, saying:

'I'm proof that Yalies with C- grades can get good jobs' (or something like that!).

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I have it on our home video. Hillary Clinton also spoke.

Years later I learned that Kurt Vonnegut once said:

‘Those now in charge of the federal government are upper-crust C students who know no history or geography...’.

Barb and I drove to a WAS get together in the Napa Valley, visited Healdsburg and surroundings, and visited with Erma in Union City. Earlier, in February, we were in San Francisco for a AAAS meeting (Steve Kern’s Errors of Metabolism session) and visits to Mill Valley. Later I had travels related to NCBRR, Smith & Nephew – in Memphis, and seminars in Milwaukee and Atlanta.

June, 2001 I went to Korea to see HB Lee at KRICT in Daejeon, and to visit with YK Sung at Donguk U in Seoul, speaking in both places.

## 9–11 and Beyond

In very early September, 2001 I was off to Cardiff, staying at the Jury’s Inn Hotel, visiting the Techniquet Science Centre, and working with S&N’s wound healing group. I had just returned when the World Trade Center towers in NYC were taken down by two commercial airline flights hijacked by Saudi terrorists. The planes were nearly full of fuel, exploded on impact, both towers slowly collapsed, largely leveled and totally destroyed. Barb and I watched the second plane hit the second tower on live TV that morning. All air space was promptly closed. All airline flights were cancelled for the next several days.

Bush declared his ‘war on terrorism’ and promptly, via his neoliberal advisors, began making an even greater mess of the world. Travel security was greatly ‘enhanced’. Various human rights were curtailed via a hastily written and passed ‘Patriot Act’. The era of strong authoritarian government had begun.

Earlier, Salt Lake City, after substantial controversy, had been awarded the 2002 Winter Olympics. There were pros and cons. One pro was the commitment to rapidly expand our very new one line commuter light rail public transit system, TRAX, to serve the UU and its now Olympic Stadium. That did happen. The East-West line to the UU opened some months before the Olympics.



Salt Lake's planning for the Olympics had been in trouble. Massachusetts ex-Governor Mitt Romney rode in to the rescue. That was good. Romney had helped Massachusetts put a serious health care insurance system in place. Pretty good for a Utah-connected Republican. We were optimistic. But...

...in between, George Bush had his presidency 'saved' that 9-11-2001 by 19 Arab terrorists, at least four of which had learned to fly jet airlines, due to their USA pilot training school! The USA was quickly physically grounded. And the mental grounding then began. The ensuing War on Terrorism has led to over two decades of fear, anxiety, and paranoia – and, of course, to the great curtailing of transparency, individual and collective freedoms, and even of democracy itself. The terrorists won: they achieved their goals – to constrain, embarrass, punish, and destroy the USA. And their effects are ongoing, not from overt terrorism, but now from domestic terrorism, fueled by arrogance, ignorance, narcissism, laziness, and flat out stupidity.

Those terrorists took off, knocked down the World Trade Center's Twin Towers in NYC and took out a part of the Pentagon – they just missed the White House, thanks to some alert air passengers with some brains and guts. And now we had Little George and Big Dick (Cheney) with their War on Terrorism.

The Winter Olympics, just five months after the 9-11 attacks? Seriously? How are we going to get people in and out of Utah – from the entire world – safely? Can't happen. But it did. The City, Community, State – even the Nation – pulled together and, thanks to Romney and his team, we had the Olympics in SLC in Feb. 2002. Yes, it was fenced, highly restricted, very security-conscious – but it was held, as scheduled – safely.

But that brand new TRAX line to the Olympic Stadium only went to 900 East, for security reasons. The upper campus Olympic Village and lower campus Olympic Stadium were considered super-targets for potential terrorists. No need to give them a light rail car to get explosives on campus.

Airports soon reopened and air travel soon resumed, although with greatly heightened security.

Chen-ze Hu asked me to travel to Taiwan in late Nov. 2001 to advise him and his superiors on the possibilities for biosensors. I gave several seminars on our biosensor work.

CibaVision also provided funding in 2001 for the development of an eventual TearChip, to measure important analytes available via tears.

## Sixty and Counting

Barb retired in 2006. I began a phased retirement in late 2004, to result in full retirement in 2015. As that was a long phased period, it required special permissions. Part of the agreement was the understanding that my teaching duties in the later years would be satisfied by *Science without Walls*.

Barb and I would be celebrating our sixties, our kids were gone and independent, and we began to consider our increasing longevity. We liked to celebrate birthdays – and we enjoyed weddings – and, of course, travels – thus, retirement!

Barb and I were (and are) very fond of Mill Creek Canyon and hiked and cross country skied there often. Mill Creek Inn is a private venue restaurant and event facility across from the Church Fork picnic area. The Inn was operated by Sasan Moatamad, the eldest son of Shahpar Ghodsi, one of Barb's closest friends. It is in a beautiful location, with outdoor as well as indoor dining and dancing spaces. We hosted close friends on Jan. 26, 2002 to celebrate Barb's 60th birthday. Barb had made some small potted plant favors to go on the tables. There was music and dancing, of course.

Sung Wan and Henry Kopecek, together with John Mauger, Dean of Pharmacy, organized a 60th birthday dinner party for me in late July 2001 at the SLC downtown Hotel Monaco. They presented me with a 'Danger: Men Thinking' road sign and lots of toasts and well wishes. Aaron and Tonio gave me a little graphic book they made in the form of a Wanted Poster.

My own Korean-style 60th was celebrated in Korea in 2002 with former students and colleagues by traveling with them to see sights in Korea. The entourage included my three Korean PhDs – Hai Bang Lee, YK Sung, and Jin Ho Lee; Young-Man Park, who received an MSc and stayed in touch for a long time; and Sang-Il Jeon, the visiting professor from Kangreung University who did the work with deGennes on PEO interfaces. Mu Shik Jhon was also part of the celebration, as was Won Kim, Hee-Kyung's nephew who was with the family Sam Yang Co. Won received a MsE (Master of Engineering – a thesis-less degree) under me. He was very personable, with a wonderful sense of humor. He had confided to me that, seriously, he would much prefer to be studying German philosophers than in being groomed to help run the Sam Yang Co.

## 4M Lab, Last Grant – Thanks, Dan!

Fortunately, in 2002 the efforts of Dan and I to secure significant NIH support finally materialized. A so-called NIH R21/R33 grant was funded in August, 2002: Multi-Analyte Micro-Devices for Biomedical Applications. In that application we proposed the need for specific chemical sensing via multi-channel bioluminescence-based micro-fabricated devices, utilizing enzyme-based and antibody-based approaches to selectivity and sensitivity. We coined the terms ChemWare, SampleWare, and InfoWare, as well as ChemChip, TearChip, RenalChip, HepatoChip, DiabChip for specific chemical panels. We considered and wrote proposals, mostly unfunded, on saliva, tears, hair, sweat, and urine as sample sources. We wrote proposals, many via PSI, on means to measure specific, individual analytes – again mostly all unfunded.

Our ideas were presented at a June 2002 BECON NIH conference. BECON refers to a Bioengineering Consortium organized within NIH to provide exposure and coordination of bioengineering-related activities and interests among the many Institutes and Divisions of NIH. It essentially evolved or morphed to become a new Institute: the National Institute of Biomedical Imaging and Bioengineering (NIBIB).

My talk (Biochemical Individuality – ChemChips for Metabolome Measurement and Management) focused on biochemical individuality and the need for multi-channel metabolite measurements. I referred to the public confusion brought about by monoparameter paradigms – ‘Vitamin C is good for you... no, in this study it’s bad for you’ ...etc. I argued for multi-channel measurement and display of the data, using radar or star plots to produce biochemical patterns characteristic of particular pathologies to facilitate diagnosis. This was fueled by our interests in inborn errors of metabolism, rare conditions often mis- or even undiagnosed due to lack of experience and information. Steve Kern and I ran a small AAAS symposium on the topic, with examples of the diagnostic odyssey which parents must endure when their newborns and even toddlers have inborn errors. We focused on PKU and Galactosemia.

Our sensor work was presented and summarized in a major paper by Rupert Davies and Dan Bartholomeusz published in *IEEE Eng Med Biol Mag* 22, 32–42, 2003: Davies, R., Bartholomeusz, DA, and Andrade, J.: Personal Sensors for the Diagnosis and Management of Metabolic Disorders – Luminescence-Based Analysis that Facilitates the Measurement of Multiple Metabolites from Small Sample Volumes for Use in Point-of-Care or In-Home Environments. The paper was part of a special section of that journal on Health Care Economics. It was facilitated by Dov Jaron and the Whitaker-NSF joint program in Cost-Reducing Health Care Technologies (CRHCT).

Rupert and Dan were an incredible duo. Rupert focused on the chemistry of the reactions and the development of the specific assays. Dan's key interest was micro- and nano-fabrication. He had come to Utah to work on nano-fabrication with Bruno Frazier. Neither Bruno nor I had the funds to support him, so we each supported half of Dan! Shortly after Dan began his Utah studies, Bruno accepted a position in Georgia and Dan was stuck with me. It worked out well, especially for me. Dan proceeded to work on the fabrication of multi-channel systems for our bioluminescence-based analyses, including simple well-like chips as well as multi-channel CD-optical disc-type centrifugal chips. The key was small samples, in the microliter range, with means to distribute and apportion that small volume to diverse, specific analytical channels, then to detect and measure the weak luminescent signal. Fortunately we had very sensitive analytical and detection platforms based on bioluminescence – both via firefly-ATP luciferase and bacterial NADH-luciferase. We'd had a lot of experience from our TIRF years with sub-monolayer fluorescence, including photon array cameras, CCD-based.

Bahar Edrissi, working closely with me, Rupert Davies, and Dong Min, organized our bioluminescence-based sensing possibilities into a Master Table of specific enzyme reactions requiring ATP (the ATP Platform) and a second set requiring NADH (the NADH platform). ATP was assessed via the firefly luciferase reaction; NADH was measured via the bacterial luciferase reactions. Between ATP and NADH, an extremely large number of enzyme-specific biochemical measurements became possible, hence the potential for a device to truly measure one's biochemical profile – and individuality. All we needed were the specific enzymes.

We studied various enzyme and biochemical handbooks, especially Gerhard Michal's *Biochemical Pathways: An Atlas*, 1999. We posted Michal's Biochemical Pathways huge double poster on our lab wall. Thank you to Boehringer Mannheim...

We were very interested in the idea of 'biochemical individuality' – via measuring the specific key biochemicals in the metabolome. This was well before the great emphasis in and success of DNA, even RNA, measurements of specific biochemical function. The work of Eu on galactose and then the extensive work of Davies on many more biochemicals provided the foundation for a true multi-analyte ChemChip – or Chem CD.

We collaborated with Ed Clark in Pediatrics on inborn errors of metabolism, including PKU (via phenylalanine), and Galactosemia (via galactose). This was also part of the Whitaker – NSF – funded CRHCT program.

Steve Kern and I organized a session at the AAAS meeting in San Francisco titled: Screening for Inborn Diseases, featuring talks by

Steve on our work,  
the UT's Ed Clark,  
Ed McCabe of UCLA,  
Tera Mize of the Tyler for Life Foundation, our own  
Norm Waitzman on economics, and  
Philip Lee on health policy.

We covered a range of topics, including:

What is rare? Is 1 in 100,000 rare?

Need for diagnosis, for closure – the diagnostic odyssey problem.

We continued our interest in chromatographic separation of proteins via Luo's thesis, and on passivation of surfaces to prevent protein adsorption via PEO approaches (Zhang).

Gwennie Yang arrived at the time we were starting to seriously consider immunosensors. We were also developing a collaboration with a major, regional analytical lab, ARUP, Inc, located in our Research Park, very close to PSI's site. As we considered immuno (antibody-based) assays, we learned of CEDIA – Cloned Enzyme Donor Immunoassay, using chemi-luminescence, which in principle made it possible to be employed on our multi-channel chip. Both ARUP (which was using CEDIA for some monoparameter tests) and Microgenics/DiscoverX, a Fremont, Calif.-located firm supplying CEDIA reagents and products, very close

to my mother's home in Union City, Calif, were very interested in the work and provided invaluable assistance. Dr. Jarmila Janatova, who I'd worked with in my early days at UTU, had been retired but very active – and interested in our work. She eagerly co-supervised Gwennie Yang. Jarmila's expertise with antibodies and immunoassay helped make the project possible, together with Dr. McMillan from ARUP. They also greatly augmented and facilitated Gwennie's graduate work and experience. Dr. Yang graduated in 2006 with a dissertation on a 'chip' for anti-epileptic drugs.

Youssef Al-Sheikh joined the group in 2004. He was a graduate student in Physics, interested in biotech and bioengineering. We talked. The Department of Physics was willing, even eager, for me to supervise him for a dissertation in biophysics. Youssef told me he was seriously diabetic and was very interested in glucose sensors, and other analytes important to diabetes. I thought it would be very helpful to our work to have someone on board with such interest, motivation, and experience. Diabetes was the largest market for small, 'dipstick'-type single use sensors. There was a lot to learn. Youssef's leaning toward physics drew him to networks, modeling, and data visualization. These were all areas we needed to consider for our eventual goal. The subject of a paper I had given many years earlier at an international conference summarized that long term goal: *Toward Dollar Devices for Measuring Metabolic Biochemistry*.

One of the major concerns in analytical biochemistry is what does the physician do with multiple channels of biochemical data? Medicine, and indeed much of science itself, is based on simple hypotheses via single parameter approaches: If this specific analyte changes, then it's likely to be because... of this specific pathology – and vice versa. The idea that a multi-analyte profile or panel might be more useful became common later, such as a panel for kidney function, another for liver function, etc. Our idea was to expand on that approach – to provide a map or pattern of biochemical data which would correlate various pathologies or disease states. Diabetes was an obvious place to begin... and Youssef delved into the idea of InfoWare and data visualization approaches.

We all worked very hard and succeeded in securing the ongoing NIH R33 funding two years later, carrying our support through July, 2006. By that time we had a complete, robust, specific, sensitive luminescence-based multi-channel sensing platform. It might have been a good time to move it forward via major funding for development and testing. But... I was aging. I had tried

entrepreneurial via PSI and was not interested in continuing (sort of a ‘been there, done that’ mindset), our funding was soon to end, and I wanted to do something different. So I decided to wrap up the research and development side of my career. People graduated, moved on, much of the experience and technology went with them. The Lab was slowly closed.

Youssef graduated in 2007, the last of the team to finish. He included several Appendices in his Physics Dissertation, including Edrissi’s Master Chart of suitable enzyme reactions for bioluminescence-based ChemChips. His Appendices provide a complete summary and archive of most of our work on biosensors.

We had called ourselves the 4M Lab: Lab for the Modeling, Measurement, and Management of the Metabolome. The NIH grants ended in 2007, after a no cost extension. The remaining funds were used to wrap up publication of the final biosensor work. Over the next several years I closed down the lab, arranged the disposal of all chemicals, etc. via campus services and gave away or transferred all equipment. I set up a very small ‘workshop’ in my MEB office to continue working on ideas and activities related to The Leonardo and science education. I continued meeting with a few graduate students (supervised by others) and with a few undergraduates, including some enrolled in *Science without Walls*.

## California Events

Pajaro Dunes is a high end condo development west of Watsonville, near Monterey Bay. I was invited there in July 2002 for an interesting experiment in biosensor design and engineering, sponsored by a young German entrepreneur who had made some money in the diabetes economy. I was part of a design team he had assembled to work on the design and development of a much better glucose measurement and diabetes management technology. The teams included biosensing experts, including Anthony (Tony) Turner, myself, and others. There were perhaps 10 of us, all invited, paid, and kept together for about 5 days at Pajaro Dunes. We had to drive some miles from Highway 1

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and Watsonville, on Beach Road, through agriculture fields with many migrant workers. The location was quite isolated, the beach was not exactly nearby, there wasn't much to do. Barb went to Watsonville on her own. We think I only participated for the first 2–3 days and then departed. It was an interesting experience in product design by committee.

On the way there we visited with Erma in Union City. She was starting to think of selling her home and moving into a senior retirement facility.

I probably visited Microgenics in Fremont to begin our discussions on enzyme-based biosensing. I also saw and worked with Sally? Svedberg at Hewlett-Packard (HP), who was using our bioluminescence materials for her HP-sponsored outreach in science education. Then we routed home via Midpines, near Yosemite, to see Brother Bob and his family.

Back in Salt Lake City our new kitchen cabinets were delivered and our bamboo floors were installed – very carefully! The floors covered over the high performance plastic piping which distributed the solar heated water for our new radiant heating system.

## The Williams

Julian Williams had a stroke in early February 2003 and was hospitalized. Barb immediately flew to California to attend to him and Le. The new City Library opened on Feb. 14, with a congratulatory gala the evening before. I attended and then went to Mill Valley to be with Barb and Julian. Julian was in a coma. I 'talked' with him about 'the other side' and about death. He died a few days later on Feb. 23. He was cremated. The family gathered in Mill Valley for a celebration of life event. We spread his ashes over nearby Mill Valley hills, near the German Hiking Club's small lodge.

Le wanted to continue living on her own in her home, but she was having falling issues. We all celebrated her birthday in June 2003; she was in good spirits. Antonia and Jill, Barb's sisters, and brother Rhys all helped. Later Antonia, visiting from Portland, found Le on the floor where she'd been for more than



a day. She clearly needed help. Rhys began fixing up a section of the downstairs to reside in, perhaps to serve as a resident care-giver. Antonia found a local friend to check in on Le, but it became clear she would need to be in assisted living. So that long arduous process began. Le was in a rehab facility near Mill Valley for a while, then one in San Rafael. Barb and I worked with her to implement a Power of Attorney. Le and Julian each had wills. Le visited with their lawyer, and we all confirmed the wills and intentions. We finally had her sign the Power of Attorney in San Rafael.

Le and Julian were prolific life-long artists. They met in San Francisco and were married there. Barb was born in The City. They then lived in Mill Valley, where Julian worked as a milkman, then on to Sebastopol-Occidental where he ran his own small ranch. They then moved to Healdsburg where they continued farming and later moved into town on Matheson Ave. Julian began working for the Roth family, maintaining and caring for their various properties, including a spectacular site in Elk, CA, right on the coast. Barb went to high school in Healdsburg and worked at the nearby city library.

The family acquired 516 Throckmorton in Mill Valley some time before Barb left for the Peace Corps. The Roths provided Julian with an ongoing 'retirement' stipend, and he continued to do jobs for them.

The Throckmorton house was ideal for prolific artists – a huge studio and workshop-like bottom floor and a large upper floor with kitchen, living room, and more studio space. Julian used the large lower floor – he had several studios, a shop, and a small bed and bathroom. The downstairs was largely his domain. Le lived upstairs and used a small naturally lighted room as a studio. She did her marble sculptures on the outdoor covered deck. The trek uphill from Throckmorton Avenue was somewhat long and quite steep. Trekking up and down, and walks in the surrounding woods, kept Le and Julian in fairly good shape.

Two lifetimes of accumulated art had to be distributed and stored. We started to clean and distribute the contents of the house and garage. Most of the art went to a large storage unit just north of San Rafael, where Le was then in assisted living. We were all unhappy about the situation. We wanted Le to be in Portland, near Jill and Antonia. She was resistant to go anywhere except home. We finally got her to Portland, via a compassionate 'Le-napping', and then into a really good assisted living facility in the Milwaukie suburb – a place called

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Oatfields. She seemed moderately ok there, although she was having trouble concentrating and communicating. She loved to listen to classical music – KDFC and now the Portland-area classical stations. In early 2007 we moved all the art to storage near Oatfields. Rhys had driven a rental truck with the art and furniture to Portland.

Barb and I rented a van one time to take Le to see the Coast. We got her in, drove to near Manzanita, on the Coast west of Portland, and positioned the van so she could see the coast and the ocean. We thought it would please her. It didn't. She complained later that she saw nothing. We tried.

Le died June 6, 2006, just before her 87th birthday – at Oatfields. They held a nice goodbye ceremony.

With Le and Julian both gone we moved ahead with selling the Throckmorton property and then disbursing the proceeds among the siblings. The sisters organized an artists show at Ft. Mason in San Francisco, August 6–7, 2006. Le had participated in many classes there and still had some friends in the area. Two of her sister Edna's three children, Pat and Mike, attended the show, as well as many local art enthusiasts. Le's four children (Jill, Antonia, Rhys, and Barbara), and their immediate families, all participated. A biographical brochure was distributed at the show, titled:

In Memory Of Two Lives Devoted to Art:

Julian Williams (1911–2003)

Le Rose Williams (1918–2006)

Two very large chapters in Barb's life – and in mine, too – were gone.

## Whitaker Foundation

Peter Katona became president of the Whitaker Foundation, replacing the retiring Miles Gibbons. I was becoming a statesman for a broader definition and focus for bioengineering, trying to urge the Whitaker Foundation to move into the Health arena as well as its current focus on diagnostics and therapeutics.

In April, 2001, my seminar at Marquette U in Milwaukie was titled: BioMedical or BioHealth Engineering?: Beyond the MonoParameter Paradigm.

It focused on personal biochemistry and on inexpensive means to ‘measure and manage the Metabolome – your unpatentable personal, private biochemical individuality.’ I argued the field needed to expand to an emphasis on Health, ‘where Health is defined to include Public Health, Social Health, and Planetary Health.’ Jack Winters, my host, heard and understood – no one else did.

In late 2005 Whitaker hosted its second and last Bioengineering Education Summit to assess the state of and opportunities for BME. My talk tried to get Whitaker and its allies beyond what I called the now ‘traditional’ BME focus – to move into third world and public health, rather than continuing to focus on hi tech, private medicine health care and development. I felt that BME had evolved from a novel, unique, multi-disciplinary, creative, risk-taking field to just another engineering discipline – that it was time for a true BIO – as opposed to just a BioMedical – Engineering. But Bio-engineering was then viewed as agriculture and waste treatment, rather than the techno- ‘sex appeal’ of BME. Some said I was trying to be the ‘conscience’ of Whitaker and of BME. I agreed.

I’d also tried to interest Whitaker into helping support efforts related to science literacy and awareness – via collaborations between BME Departments and their local science centers. We submitted two different ‘Special Opportunity’ proposals – in 1993 and in 2002 – on such a topic. They declined.

In 2005 as Whitaker was closing down its grant programs and releasing the SAC, Bob Nerem, as I recall, suggested we keep the group together by organizing the Whitaker Alumni Society (WAS). We would continue to travel and meet, with our wives or partners, and simply enjoy each other’s company in interesting locations. We did excursions to Napa Valley, to Quebec City via Montreal (2007), and to an island near Portland, Maine – Chebeague – thanks to Murray Sachs of Johns Hopkins who had a home on the island. Aaron met Barb and I in Montreal in 2007, where we enjoyed a special city, including its science and environment education facilities. We then traveled to Quebec City for the WAS gathering, really enjoying the uniqueness of the place. Barb and Aaron employed their French skills. I enjoyed visiting the science and climate educational facilities in Montreal. On the way there I talked with some people involved with the neurology of music at a meeting, including Petr Janata (the son of Art and Jarmila) and a colleague of his. I was interested in exhibits and activities related to music and the brain.

## Retirements

In July, 2005 I began a long phased retirement, culminating in full retirement in 2012

In the last several years my only teaching responsibility was the *Science without Walls* telecourse, labeled as Bioengineering 1510.

In order to give up and fully vacate my Merrill Engineering Building (MEB) office, I started to ‘process’ the many hundreds of files and over a thousand books – with hundreds more in the basement office at home.

It was probably in the middle of this decade, say 2005, that Barb and I were visited by Jeff Hatch, an acquaintance who lived upstream from us and was very knowledgeable in local democratic party politics. He inquired about The Leonardo and its potentials. He also suggested Barb and I consider participating in a Salon group that his wife, Peggy Hatch, had co-founded some years earlier. Bob Huefner, and his wife Dixie, were also participants. The group met bimonthly for a pot luck dinner and discussed a socio-political topic of mutual interest. I had worked with Bob on the NSF-Whitaker CRHCT grant and on related health care events. We knew of Dixie via her work with the League of Women Voters (LWV). We accepted the invitation and have been regular Salon participants ever since. The group was limited to 6 or 7 couples so that hosting a meeting wouldn’t be a big burden – and to insure that all had a chance to speak and interact. Others in the Salon group include Lydia and Tom Berggren, Susan McNamara and Al Hayes, Sandy and Jerry Kaplan, Mike and Susan Arnow (no relation to Barb’s Arnow relatives).

Barb retired in mid-2006; she had become annoyed and uncomfortable with the increasing emphasis on testing, reporting, and bureaucracy in the teaching system. She and friend Carol Drown took a course titled Prime Movement (dance for those over 40!) via Reperatory Dance Theatre (RDT). She loved the course, and has stayed in touch with Sarah Donahue and Aaron Wood, her early teachers; they are each academic and professional dancers.

Barb also volunteered in the children’s section of the Sprague Library in the Sugarhouse area. She enrolled in a Master Gardner program via Utah State University, receiving her certificate in Dec. 2009. In 2011 she worked with Lisa McDonald and SL County to organize a Community Garden at the Scott

Avenue Park a few blocks from our home. She had her own plot there for the next five years or so, all the while working her two ‘plots’ in our yard.

Bioengineering undergraduates hosted a Lunch with the Professor series in Spring, 2008. Although I was no longer actively teaching bioengineering courses, or doing research, I was interested in getting undergrads interested and involved in public science awareness and education. I talked with them about The Leonardo and *Science without Walls*. Jake Hanson was one of those participants. He was interested in sustainability and related big topics. We started interacting. Soon he was working with me on The Leonardo’s Magic Planet exhibit and shortly thereafter on A Big Picture, with Hugh Bollinger. He received his BSc in 2009 and continued working with us. He had interests and skills in programming and website implementation.

## Weddings 2004–11

We like weddings as well as birthdays! Nina and John were married in May, 1997 on an island in a lake south of Munich (Chapter 7).

In early 2000 Alex Kim married Cathy at Le Caille restaurant and grounds in Salt Lake County.

Sung Wan’s extended technical community and Alex and Cathy’s family and friends were all present in a spectacular setting.

In June 2004 we traveled to Amsterdam, then on to Bonn, with Tonio, to attend the wedding of Jamie Lee and Judith Wamser. Jamie and Tonio have been close friends since high school. It was a pleasant semi-formal affair with the bride and groom posing with us and German flags. Tonio, Barb and I continued to Brussels, where Tonio then routed back to Leiden where he was studying. In Brussels, accidentally, in a subway station, we saw a tiny science center, using mirrors and visual illusions. Very well done. I made contact with the founder and staffer, and got some good ideas for exhibits. We also traveled north to Technopolis – the Flemish Science Centre.

In October, 2004 we were off to Rochester for Tonio and Andrea’s wedding. They met online and via a bookshop in Rochester, where Tonio had his

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first academic job at SUNY-Brockport. Aaron met us there as did Tonio's close friends Jamie, Jonathan, and Alex Kim – as well as Sung Wan and Hee-Kyung Kim. We met Andrea's Artuso family and her current family (van der Sande). Andrea had her two fathers walk her up the aisle. The reception featured lots of dancing and a beautiful double rainbow.

The first of the three Hibbs family weddings was in June 2005: Claire Hibbs and Mark Cheff's wedding at the groom's family ranch north of Missoula, near Ronan. Poet Claire was becoming a cowgirl! The Cheff's have a large ranch, many horses, and run expeditions into the nearby Bob Marshall Wilderness for sportsmen and adventurers. It was an outdoor wedding, light rain, a phenomenal reception, and many guests. Most, including Barb and me, went on a guided horseback ride into the surrounding forests. Magical. Claire and Mark now have two children, Juliette and Luc, each of whom are well educated in horsemanship and participate in the wilderness excursions.

Grand Targhee resort, just west of Grand Teton National Park in Wyoming, was the next Hibbs wedding: Luc and Linze – in August, 2010. Luc's older brother, Jon, did the officiating via his online procured credentials! It was a remarkable setting. We took the cable car to the top with my Vernier Instruments  $O_2$  and  $CO_2$  sensors to do test and calibration measurements. I was very interested in demonstrating oxygen concentrations as a function of altitude. So we sat on the top of Mt. Targhee measuring  $O_2$  – and  $CO_2$ . Luc and Linze are avid ski mountaineers. Each table at the reception dinner had a picture of the two of them at the top of some mountain – perhaps 30 peaks – all different!

Then in Aug. 2011 it was Jon and Ginger's turn via a 'shotgun' wedding. Daughter Tess was already on the way! Jon and Ginger had been together for many years, living in Victor, Idaho.

The wedding ceremony and reception were on the grounds of a facility in Victor, just a few blocks from the remarkable log 'cabin' which Jon and Ginger had built over several years. Jon did construction work over the border in the Jackson Hole area; Ginger ran a landscaping firm.

We met her remarkable, 100 year old, grandfather who would fly his own plane in the sprawling landscape of Eastern Idaho. Jon was the last – and the oldest – of the three Hibbs children to get married.

Three children, three different states, three dramatic mountain settings. What a family!

## Erma and Manny

My Dad's unexpected 'spark' (Chapter 2) kept growing. Littlest brother Manny was born August 3, 1961. His two brothers were much older and generally far away. His parents were middle age; no other kids nearby. He didn't do well in school, was in and out of detention in high school, and generally 'got into trouble'. When he was a toddler Barb and I would take him on outings and excursions, but those times were few. Manny and Dad were often at odds – both were self-focused, cold, somewhat arrogant, and temperamental.

I have many photos of Manny as a toddler, and many with Erma in her later years – but not very many in between. We were never very close or particularly interested in each other. Ditto I think for brother Bob. Bob was generally far away, had Joyce and their growing family, and had his own issues and challenges. Manny was largely on his own much of the time. He almost always seemed to talk or bluff his way out of trouble. When he ended up in jail, Erma would send gifts and money, as allowed. He lived in Carson City for a while, with Bob and Joyce. That didn't go well.

Manny married Debby (his second wife); soon Stephanie was born: Jan. 9, 1996. Deb and Steph provided some responsibility and stability for Manny. But his smartness, often self-centered attitude, and general arrogance got him into semi-regular trouble. He was incarcerated in Feb. 1996. Deb and Steph were in Hayward and Fremont and interacted often with Erma.

Right around Fall, 2000 Manny's Holly Lane Hayward residence was raided and searched, a gun found in his car (not his, he says), so he was arrested. After his arrest a 'bomb' was found in his car (planted by his own roommates). The Feds knew the gun wasn't his, nor was the so-called bomb, but urged him to take a plea deal, as otherwise he would get a much longer sentence. So Manny got a ten year 'deal'. He was in jail, this time on Federal charges.

Deb had to function as a single mother for the next ten years. Steph was often without adequate care. Debby had major problems with hoarding, clutter, drugs. Once, when Debby and Steph were homeless, Mom allowed them to stay with her in Union City – in the second bedroom. Deb moved in, over-filled the room, and would not move out. Mom adored Stephanie and did all she could to take care of her. Steph was often dirty, hungry, simply uncared for as a toddler.

She was about eight years old at this time. Deb was likely on and off drugs at various times.

## Erma's Story

Erma turned 83 in 2004. She was very well organized, was frugal and prudent with her finances, and generally in control of her life. She revised and formalized her Will in 2004. She had been volunteering with the local Our Lady of the Holy Rosary Parish and its affiliated groups, including taking the lead on establishing a city park across the tracks from her home. Although she was in very good shape, she was thinking about her future in a house and yard. We began to talk about communal living facilities, with the option for assisted living if and when she might need it. We took her to look at several facilities in Fremont. One of them looked very good to her – and to Barb and me – Merrill Gardens, near Mowry and Paseo Padre.

Solving the Deb problem was, I think, one of the reasons Mom went forward with selling her home and relocating. Brother Bob joined me one weekend with a pickup, and we began moving Debbie. I had obtained a large storage unit nearby, paid it for a year in advance, and told her the stuff goes into the storage unit or is discarded. She knew this was scheduled and was furious. She had brought a friend to help her comb through all the stuff she had acquired and hoarded for several years. I don't recall Steph being there – she was probably elsewhere in the house with Erma. Bob and I were patient, but very insistent. A very difficult day for all. We left Deb with an overfull storage unit and the storage facility dumpster nearby. Rather than put stuff in the dumpster, she found other stuff in it she 'needed' to keep. She was largely homeless at the time – and still hopeless. But she was out of Erma's house.

We cleared and cleaned the room, and put up the For Sale sign on August 3, 2004. It sold within two weeks, at about \$400,000 – to Erma's neighbor! Home prices had been going up rapidly in the Union City-Fremont area, fueled by the growth of nearby Silicon Valley. Erma quickly invested most of the funds in a retirement annuity which served her very well. She also had a monthly income



from her state pension and social security. Just prior to the sale she had made arrangements for a studio apartment at Merrill Gardens, where she lived for the next 12 years.

Barb and I helped with packing and moving in – on Aug. 22, 2004. She had been preparing for months, downsizing her possessions and accumulations after over 60 years of living at 33757 12th Street, Union City. I took some of the tools from Dad's tool shed. Nearly everything else was given away. She easily accommodated to her new studio apartment, her constrained space, lack of a bathtub, and lack of her precious cat. She had a small balcony, overlooking several large trees bordering the street. It was a pleasant place.

Erma had several old friends already at Merrill Gardens, and she made some new ones. There was communal eating with really quite good food, as well as various activities. Mom was fond of puzzles and Bingo, as well as gentle exercises. She did some painting, liked to crochet and knit, and kept herself alert and occupied. She liked puzzles, didn't watch much TV. Her Kaiser Health plan was very good; she did all her regular maintenance with them. They really took good care of her. She had parking for her beloved Geo Metro and kept driving it until her later eighties. She had to use a walker in her later years.

With Erma's move to Merrill Gardens and her gentle aging, and with my very intense professional decades now behind me, I had more time to spend on family interactions and perhaps responsibilities. Barb's parents were also aging. We spent more time with them, too.

We traveled to the Bay Area often, to and from Mill Valley and Fremont. So Manny, Deb, and Stephanie were now in my field of view, as well as Erma and Le Williams.

Bathroom stops became a major concern for Erma. We took a birthday trip to Half Moon Bay in early 2007 and had lunch overlooking the Pacific. She looked radiant. In early 2008 we drove, with Stephanie, to the US prison in Atwater, where Manny was serving time.

Erma's older brother John had been ill and on dialysis, and was rapidly failing. In October 2008 we drove down to Hanford to see John. His sons, Jimmy and Ronnie met us and directed us to his home (or perhaps Jimmy's) where John was being cared for. He was in a semi-coma and very close to the end. Sadly, he and Erma did not really connect, but she did pay her last respects there, just days before he died.

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Erma and I traveled again to Atwater in January 2009. We had a small problem. There are strict dress codes for visitors as well as inmates – so the guards ‘can tell the good guys from the bad guys’ we were told. Mom had on ‘bad boy’ colors. I was OK. The ‘receptionist’ at entry refused entry to Mom. Erma didn’t have anything to change into. We’d have to go in to Atwater, over five miles away, to buy color-correct clothes. I saw the entry area guest bathroom door. I took Mom’s hand and we both entered the Men’s bathroom, while the guard was sputtering we can’t do that. We locked the door and quickly swapped ill-fitting pants. We were out and decent before the sputtering stopped. Mom got in to see Manny. I waddled out in Mom’s very small pants to the car to go find a park in Atwater. I was not permitted to wait in the prison lot nor in the ‘guest’ area. So off to Atwater I went, to a tolerant McDonalds for the next half hour or so. A memorable event and visit. We didn’t bother rechanging until we got home, stopping to take bad pants selfies on the way. Manny was very pleased. And it makes a cool story.

The last real excursion I took her on was in March 2009 to the Monterey Aquarium. We had bathroom near misses on the way in to Santa Cruz and again in Capitola. But we made it to the Monterey Peninsula and the Aquarium. She was always fond of Seaside and Monterey as her father, Gregory, had worked and lived there. Also Dad did his military basic training in Fort Ord, in 1944.

Mom did well at Merrill Gardens, which became Brookdale during her last years there (it’s now called Cogir of Fremont). After she’d been there for 4 or 5 years Barb and I kept talking with her about writing her life story – a short memoir. Aaron and Tonio also encouraged her. She began, in longhand and pencil, writing her recollections from her childhood to the present. I would type and save them and occasionally return a printed copy to her for updating, revising, and editing. I also scanned and input many of her photos, integrating them with my own photo library – now some 15,000 photos. After some years she had a complete rough draft. We selected photos to go with some of the text. Aaron started to design and format *Erma’s Story*. In 2010, when she was 89 years old, we ‘completed’ and printed the booklet. Aaron did a great job of design and formatting. It’s available online as *Erma’s Story* at [joeandrade.org](http://joeandrade.org).

Mom never planned to be as old as she was becoming. Although in good health for her 90 years, she had developed posture and balance issues, using a

walker to get around. She had to give up driving. She could take short trips shopping and to local venues via the Merrill Gardens shuttle service.

She was pleased to help organize a 90th birthday celebration for her. She wanted – and we wanted – to have a life celebration while she was still in good enough shape to enjoy it. We rented a large events room at a Denny's in South Hayward for March 26, 2011, almost on her 90th birthday. All could order from the Denny's menu. We set up some materials and displays, including the newly printed copies of her 'memoir'. Aaron was there and helped set up, as well as having designed and delivered the memoir. Tonio couldn't make it.

We invited the whole extended Maciel and Andrade families and all her friends. It was quite a turnout. Bob, Joyce, and their kids drove in from Louisiana – their daughter Michelle came with her family. The Dutra family (my father's sister Anne), Ron and Jim Maciel (Erma's oldest brother's kids) came from the Fresno area, and many others. Erma's only living sibling, younger brother Bill, came. Manny, Deb, and Steph were also part of the party. This was one of the few times Erma's three sons were all there for her.

We arranged to set up a Skype connection with her grandson Tracy who was working in the Philippines. Tracy, his wife Wagie, and their two children, were up quite early to talk live with Erma. It was a great connection. Tracy was already suffering from early cancer at the time; he returned with his family to the USA several years later and died in Louisiana. Brother Bob died May, 2019, two years after suffering a serious stroke.

An old high school friend, Bob Hidalgo, had heard of the event and just showed up! His mother ran the five and dime store next door to Decoto Elementary, my primary school. Bob became a star quarterback for the WUHS Huskies, receiving a football scholarship to some Colorado school. It was great to see him and reconnect.

The only sadness was that her grandson Todd was incarcerated and could not participate. Also Bob and Joyce had had a major falling out and separation from their eldest son Robie, back in 1996 or so, when they were living near Yosemite. Rob did have some issues with people-people interactions. He blabbed to a girl acquaintance about his parents renting land to some drug dealers; her dad was a cop. Presto, Bob and Joyce went off to jail. They never forgave Rob. It's a long story...

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I did arrange to sponsor a visit or two from Rob to Erma at other times. Rob was living in Portland, then Salem, Oregon – he was quite close to and fond of Erma. I had tried several times, as did Erma, to get Bob and Joyce to relent on the shunning of their eldest son – to no avail. Bob threatened to not participate in her birthday celebration if Rob was present. So we let it go. Erma was of course quite disappointed. We helped Rob out occasionally, until he cut off communication with me in 2017, ticked off because I tried to constructively criticize his money management challenges. He's still in Salem, I think.

Deb was very fond of Erma and helped a great deal. Erma had provided funds to enable Deb to take a course on becoming a massage therapist. She got through the course, worked in several massage therapy shops, and had her own clients as well – many of them living in Merrill Gardens. She would occasionally give Erma a massage, leaving her feeling much better, standing taller, and generally in better shape.

Steph was attending my old alma mater, WUHS, at the time. It was literally just a few blocks away from Merrill Gardens. We encouraged her to stop by and visit Erma whenever she could. Steph had her own issues and problems. Growing up with Deb was not easy – Steph had an extremely difficult and challenging childhood, including medical-dental repercussions.

## More Manny

The Atwater us Penitentiary was Manny's residence in 2008–09. Erma, Stephanie, and I drove down to Atwater to see him in April, 2008. It was a good visit. Manny interacted with Steph and Erma, posed for photos, and was generally pleased. While in Atwater – and his previous 'residences' – Manny applied himself, earning various certificates related to anger management and engaged in music activities. He was an avid guitarist.

My interactions with Manny as an adult grew from about 2010 on. He was older, more functional, and increasingly interested in and concerned about Erma. He had served his Federal plea deal time – nine years plus parole, was

out on probation via a halfway house transition assignment in Oakland, then drove truck for Goodwill Industries. He would visit Erma regularly.

The rules are that if you're on probation, you cannot associate with anyone else on probation. Manny and a friend were caught, and, thanks to a kind probation officer, he was back to Halfway House, this time in San Francisco, rather than back in jail.

Manny seemed to always be able to find work and friends. He was a great mechanic, repaired cars and light trucks, dealt with electronic equipment for autos as well as musical equipment. He would research and study the problem, dig into it with tenacity and focus, and often make his landlords mad. The problem he was working on needed to be solved, even if it involved messing up rugs, furniture, and yards! He helped his friends and they helped him.

This time when released from the SF Halfway House he found a place in Richmond. While there he and Steph, visiting from Fremont, experienced the Chevron refinery explosion and fire on August 6, 2012. He then downsized to a place in Oakland, on School Street, in mid-2013. While in Oakland he and friend Verne had been visiting Erma in Fremont. On their way back to Oakland, Manny was pulled over in Union City. He and Verne were sent to Santa Rita, perhaps for a parole violation, the car was confiscated, and Manny went back to jail for 3 months. I worked with his landlord, a James Lawson, a kind and helpful man, to clear out Manny's apartment. Some friends took his audio gear, I stuffed his clothes and all other stuff I considered valuable, into a tiny rental car. Lawson helped me bag and dispose of everything else. Off to Erma's I went with a car full of Manny stuff. Erma and I organized it, gave much to the local Goodwill, threw much into dumpsters and garbage cans in the Fremont Shopping Center. Erma and I boxed up everything else, labeled it, and stored it in her small walk-in closet.

I recall a difficult conversation with Manny one time, probably after I picked him up upon his release from Santa Rita. He almost jumped out of the car, I think in Niles Canyon, because he thought I didn't 'believe' him – that I distrusted him. He was right. I had learned not to fully trust him. We parked in front of Erma's place at Merrill Gardens and had a talk – about him vs the rest of the world. I explained, he did listen:

It's not ALL about him, I tried to say. His world needs to include others – Mom, Deb, Steph, me, ...It started to sink in, perhaps because he'd grown a bit.

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Up until about then, everything that went wrong was not his fault – it was Verne’s, or the system, or Deb, or his defender, or the cops... But this time I think he understood that shit happens to him because he attracts it – he brings it on. And that would have to change. In April, 2013 I wrote a short ‘psychological’ assessment of him after his Santa Rita incarceration. He responded quite maturely and positively, although I know it hurt him, but it had to be said:

Manny is very smart. He can process information and situations quickly. He can think and respond to situations and events quickly. He’s had to respond and adapt to many difficult situations, many arising from his experiences in prison and with the justice system.

Manny works hard. He has put in long hours at difficult jobs to try to make his way. He has good technical skills, especially auto mechanics. He has good people and communication skills, and has been a successful tele-marketer.

Manny is to a large extent kind and compassionate. He cares about people, makes friends easily, and tries to help and assist people.

Manny has an ‘optimistic’ view of situations and people. He is not a realist, and generally not objective. He constructs a view of the situation which reinforces his optimistic or preferred views of situations, conditions, and events.

He rarely tells the ‘whole’ truth. When questioned, he tells partial truths – those parts which fit with his non-objective view – with his preferred view of the situation. I don’t think he intentionally lies. His perception is distorted so it can support his unrealistic view and interpretation of the situation. Generally, I think, he believes that what he says is true.

He readily ‘uses’ friends and acquaintances but will discard them when they are critical, non-supportive, or cease to be ‘useful’ – even immediate family. He is especially sensitive to criticism, to any challenge that he is not telling the truth, or the ‘whole’ truth. He sometimes ‘blows up’, pulling the plug on the relationship – until he ‘needs’ that person a little later. One could call such behavior that of a liar, a manipulator,

a hypocrite. But it's also tied to his positive view of situations and his smarts and ability to craft solutions, approaches, or paths to get out of such situations.

He acts as if he is 'above the law' – that the rules can be broken – that there is always a way out – a way around the charges. And given his brains and skills – and ability to make friends – he often succeeds. But now his record is so long that the justice system, and especially the police, think they 'know' him. When they pull up his record, they see his many prior convictions, and off he goes back into the criminal justice system.

A new problem, in my opinion, is that his extensive record and reputation puts anyone associating closely with him at risk of being viewed as an accomplice, as a co-defendant. This happened with the current case – Vern Pierstorff, a close friend, was in the car and is now a co-defendant.

I have mentioned this to the friends and acquaintances that have contacted me, so they are aware of their own risks.

In our visit and discussion at Santa Rita, Manny and I very briefly discussed much of this. I think he now understands and can process the problem and situation – and the risk to his friends and family. And I know that it hurts him greatly.

He is a social person – he needs friends – he really wants to help – and be helped. I think we both know it will be very difficult for him to rise above these problems, to recognize his very Manny-focused view of people and situations. It will be difficult for him to become a realist and to overcome trying to 'game' the system. He needs counseling, direction, perhaps treatment – but may well refuse it, even if it is made available to him. He has good friends and family who care. But there's only so much they can do. They have their own lives, issues, and needs.

Three months later Manny was out, secured a warehouse 'living' space in Fremont, and set up shop again, until the warehouse burned and he lost everything. Shit happens.

## Erma in her 90s – and goodbye

About that time and shortly after, Erma developed some serious heart issues, including unstable blood pressure. She had some falling and dizziness episodes, even some wandering issues. Manny was very concerned. I had arranged for a woman who was available to look in on her, for a fee. Deb and Steph who lived nearby, checked on her irregularly. But Manny, Deb, and I agreed she needed some permanent help. And Manny just stepped up. Why not him? He owed her, he said, for sticking with and by him all these years. Barb and I thought it would be good for Erma – and for Manny.

Manny set up ‘shop’ in Erma’s tiny studio apartment in late 2013. We knew it was bending the rules a little, but Manny and Erma accommodated each other remarkably well. Fortunately Deb and Steph lived a mile or so away. Debby’s profession was massage therapy. Erma became a semi-pro-bono client. After learning how good the massage was for her, I ‘contracted’ with Deb to provide more massages, ideally one per week.

There were several part-time caregivers who worked in the facility, with Merrill Garden’s approval. Mom knew them and would occasionally call on them to help. Between Deb and the other care-givers Mom was able to bathe and generally take care of herself. Manny could occasionally leave to do odd jobs and spent time at Deb’s place, working in her garage, on cars. We obtained a bicycle for him to travel between Deb’s and Erma’s places.

We expanded Erma’s quarters to a 1 bedroom apartment at Merrill Gardens in late 2014. That gave Erma her own bedroom, and Manny had his music and computer studio in the living room – also his sleeping quarters. Manny provided the nearly full-time attention, service, and support she needed. He worked with her to purchase a recliner, which made her much more comfortable.

Erma’s mental faculties were still very good. She took care of her accounts, annual IRS filings with the aid of a local tax preparer, wrote her own checks to pay bills, balanced her check book, and made small donations to a range of humanitarian causes. She had updated her will; she had most of her savings in a good interest-bearing annuity. But about this time she often forgot where she’d



put the check book. There were several such instances, including once where we had to order all new checks for her – and then she lost that one (for a while). Manny would get frustrated with and concerned about her memory loss. We set up a system to monitor her daily pill taking and doctor's appointments. She was on a Kaiser Medical plan which provided very good care and followup.

When Barb and I visited Pacific Grove we would spend time with Erma and Manny and help out as best we could. In late 2015 Erma had a fall or two. I would drive from the Monterey area to Fremont in about 90 minutes to check on Erma and otherwise help out. The situation started to fall apart in Jan. 2016. Mom was in her bed and tried to get the phone, falling out of bed in the process. She was in great pain. Manny got to her quickly, called for an ambulance, and took her to the nearby Kaiser Emergency Room. They quickly diagnosed her with a broken hip, requiring surgery or immobilization.

Erma and I had discussed Living Wills, the California POLST directive: Physician Orders for Life-Sustaining Treatment. She had indicated some months earlier that she did not want resuscitation treatments in the event of a medical emergency. The bright red form was prominently posted on her refrigerator. She was nearly 95 years old. She refused surgery, choosing instead to be largely bedridden. So Kaiser transferred her to the Windsor rehab facility, next door to the Merrill Gardens complex. Here she was to learn to live with her pain, largely bedridden. Any movement caused her excruciating pain. She couldn't be at Merrill, and could only be at Windsor for a few days.

Manny and I looked for a hospice-like care facility. We found one in a large private home in Fremont, just several miles away. Manny had Erma's Geo Metro and could get around easily. I made the arrangements, we organized the move from Windsor to the care facility. With these arrangements in place, Barb and I went ahead with our plans to leave Pacific Grove and return to Utah. We were home just several days when I got the call from the Windsor Medical Director. Erma had been scheduled to leave Windsor that day for the care facility. Manny had lined up the transport and help. The Medical Director told me simply that 'Erma has passed'. She had been under heavy medication for pain, and was likely medicated to facilitate her movement and transport to the new care place. But she simply stopped breathing and died.

She had received last rites a week or so earlier when she was at Kaiser, by one of the Brothers of the Our Lady of the Rosary Catholic Church, where she

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had worked and worshipped during her days in Union City. She kept saying to him 'It's time for me to go. I never intended to live this long.' She then fell asleep. I talked with the Brother for a few minutes. He said something like God's plan sometimes needs a little nudge, suggesting Erma was voluntarily shutting down. It just took her a few more days to complete the 'nudge'. Manny was at her side almost to the end. He had stepped out to talk with the ambulance people preparing for her transport. Erma's death is recorded as: Noon, Feb. 13, 2016 – just before Valentine's Day and about 6 weeks before her 95th birthday. Cause of death was cardiopulmonary arrest and gastrointestinal bleeding.

She had made and pre-paid all her funeral and burial arrangements. She had a plot next to her husband, Joe Sr, at the Holy Sepulchre Cemetery in Hayward, and the funeral and mass arranged at Our Lady of the Rosary Catholic Church. We worked with the Fremont Chapel of the Roses and with the Church for her viewing and other arrangements. The funeral was held on Friday, Feb. 19 at 10 am, with her beloved Father Jose Leon officiating. Her extended family was present, Bob and Joyce had driven up from Louisiana.

After the funeral I had organized a reception at Merrill Gardens for friends, family, and her caregivers. For several hours we talked about Erma and her interests and accomplishments. We displayed her memoir, *Erma's Story*, which had been 'published' for her 90th birthday. We had good food and remembrances, photos, momentos, etc. And we began to disburse and give away her possessions. Bob and Joyce left early to drive back to Louisiana.

Manny and I rented a storage unit nearby. He arranged to move her furniture and possessions.

I started dealing with Erma's will and the disbursement of her financial assets. We had discussed this earlier when she was in good health. It took some time to work with her annuity account to get the funds transferred into a special account from which I could disburse the funds. After paying all bills and her 2015 taxes, Bob, Manny, and I each received  $\frac{1}{3}$ . It was her wish that the funds be used primarily, if possible, to assist her grandchildren's education. She willed some funds directly to Stephanie to use for her serious dental issues. I sent a small portion of my share to Rob Andrade, Bob and Joyce's eldest son, as he was estranged from them. Manny set up an account for his share and carefully and I think wisely used them to begin his new life without Erma. He had devoted most of the last several years in directly caring for her.

Fortunately, Deb's house in Fremont made it possible for Manny to live and work in her garage for a short time. He worked on cars, odd jobs. He found some jobs in the Santa Rosa area and later spent much of his time in Santa Rosa. He was there in 2017 during some of the severe fire episodes in the area. He worked for several people doing repairs; he served as a handyman, fix-it man. He acquired a used RV in late 2017 to live in and work from. He was interested in acquiring some property to live on, initially via the RV. I was very interested in acquiring and 'saving' property, so I offered to help him.

He found some six acres in the Round Mountain area East of Redding in early 2018. Barb and I provided the funds he needed to acquire the land in early May, 2018. He moved his RV onto the property and lived in Round Mountain and with a friend in Santa Rosa. Later we helped him acquire a used backhoe with which to grade and maintain the property. His development and use of the land has been slowed down by the COVID outbreak in 2020 and beyond. He is now residing with his friend in Cotati, near Santa Rosa.

## Anniversary Travels – from 2006

Barb and I often discussed making short trips to celebrate our anniversary by escaping Salt Lake's often harsh winter months, with their regular very unhealthy levels of air pollution – caused by living in an urban high mountain valley prone to thermal inversions.

As we both approached retirement, with somewhat decreased professional duties, we implemented our new anniversary travel 'tradition' with a several week trip to Puerto Rico in March, 2006. We landed in San Juan, booked a car, stayed at a historic downtown hotel, and toured. We then drove west, staying in Areceibo, but not visiting the unique telescope there (at the time). We hiked a local rain forest, interacted with the beaches, ate. On around to Malaguez, then Ponce, and up and around the East side of the island back to San Juan and a

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flight home – perhaps via Atlanta. A beautiful trip. We stayed at a place on our way back on the edge of a forest with many little Choqui – very entertaining.

Barb had been planning to retire – and did so effective June, 2006. Barb's mother, Le Rose, died on June 6, 2006, the same week that Barb retired from teaching. It would take me six more years before fully retiring, although I began phased retirement in 2006. My phasing out duties were such as to give me a flexible schedule. We enjoyed anniversary traveling and continued our new tradition.

Our 2007 trip was to La Jolla and San Diego. We had been there before, thanks to Whitaker gigs. It picqued our interest in the California coast.

2008 was Death Valley. We flew into Las Vegas and rented a car. They offered us a red Prius! Wow. What luck. We were likely Prius-hooked from that day on. We stayed at the National Park Lodge Motel.

We began to focus on the Central California coast: San Luis Obispo, Morro Bay, Cambria, and Monterey. We stayed at Asilomar State Park in Pacific Grove in 2011. November 27, 2013 we began a two or so week stay at a studio apartment attached to a very large home at Siren and Del Monte Streets in Pacific Grove. It was owned by a Mr. Roeloff, a former Dutch civil engineer. The studio was surrounded by trees, had two great skylights, a terrace, and was just a block from the magnificent coast trail. Roeloff's studio apartment was where I began the serious preparation for writing *State Change* (Chapter 13) by reading and studying socially relevant activist fiction, including *The Jungle*, *The Grapes of Wrath*...

We stayed at another place for a short time, then routed south to spend Christmas with the Arsalans, and New Years with the Blauers and Neymes in Hermosa and Redondo Beach.

We then went back north to Pacific Grove staying for several more weeks at a townhouse apartment on 7th Street, with great views of the Bay. We explored the Pfeiffer parks, Garrapata State Park, Redwoods. Aaron was with us for part of the stay. Barb's brother Rhys came by for a short time, routing north from working at his friend Janet's place in Morro Bay. We traveled to Fremont many times to see Erma. It was a long and wonderful stay. From then on our winter escape was in Pacific Grove. The weather matched our metabolism, Erma was nearby, and the walking and views were simply wonderful. Paradise.

## Technical Transitions

PSI was dissolved and closed in mid-2000. *Science without Walls* aired every term on KUEN Channel 9, and was my major teaching assignment. It last aired Spring 2012. I fully retired a few months later. The Leonardo opened, finally!, in October, 2011. My only continuing involvement was as an informal science advisor.

Smith & Nephew closed its Scientific Advisory Panel in 2005. The company had grown and its major operating units would be setting up their own approaches to outside input. I was asked to serve on a panel for the Wound Management operation, which went on for several more years.

## Welcome – Amalia and Manzanita

A few months after Barb's retirement in June, 2006, she became a grandma! Amalia was born on September 3 after a long, difficult labor ended in a Cesarean section for Andrea. Amalia was likely named for her Portuguese heritage – the fado songstress Amalia Rodrigues. Her middle name is Jane for her maternal grandmother, Jane van der Sande. Barb and I flew to Atlanta a month later to meet Amalia. Tonio and Andrea had an apartment near Emory University. We enjoyed our new grandparent status.

We had often traveled to Portland to see Aaron, and Barb's sisters Antonia and Jill. After some short stays in Manzanita, a village south of Cannon Beach, due west of Portland, we decided to rent a large home there for a week or so in mid-July, 2008. Manzanita had been 'discovered' and recommended to us by Antonia and Paul. We immediately became attached to it. It had a large classical beach AND wonderful hiking nearby: Neahkahnie Mountain, Cape Falcon, and many great beaches and parks along the central Oregon coast.

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Two year old (almost) Amalia met Erma at Merrill Gardens in July, 2008. Amalia rode around in Erma's walker, got in and out of her Geo Metro – and Erma's lap... Erma just loved the interaction. And today, some 13 years later, Amalia can slightly recall Erma and her walker!

Tonio, Andrea, and Amalia then routed north from Fremont and Erma to meet us on the Oregon Coast in Manzanita – the first of our summer in Manzanita family reunions. Aaron and Tonio were very supportive of our spending their inheritance on travels and family gatherings. Amalia met Walter and Marley, the Manda's two large poodles, met her aunts (Antonia and Jill) and Scott Newcomb – her 'outlaw' uncle-in-law.

We all played on the beach. Aaron and Scott (Jill's to be and then husband – now Amalia's Uncle Scott) played frisbee and soccer. Andrea was pregnant with Sylvia. We hiked, cooked together, ate and told stories. It became an annual tradition to this day. In 2009 we rented a place closer to downtown, and discovered the nearby Susan's Beach 'Cottage'. In 2010 we rented Susan's Cottage, which had a piano and a kid's playset. There was much music.

## Barb and Fanny Meet

Soon after retiring Barb began volunteering at the nearby Sprague Branch of the SLC Public Library (SLCPL) System. She worked in the Children's Library, where she met Tessa Epstein, who spoke fluent Spanish. Barb loved to speak Spanish and, through Tessa, soon met Fanny Guadeloupe Blauer. Fanny was and is very outgoing, dynamic, and creative. Barb and Fanny quickly connected, bonded, and became almost inseparable. Her kids were very small, roughly 1 and 3 years. Fanny's father in Mexico City had just died. The Andrade-Blauer families became very close – we still are, some 16 years later. We treated their two kids, Danny and Juliette, as our own grandkids – and had a great time together. Juliette's high school graduation event was in our back yard; Danny graduated high school in 2023.

Through Tessa and Fanny, Barb got connected to Amigos e Libros, a Spanish language book club that met monthly at the Sprague Library. And through

Amigos e Libros Barb met and we came to know Paola Choquettilla Neyme and her husband, Dylan Neyme; Maritza Sotomayor and Carl Johansen; and others. Barb immediately became a key part of Amigos Latinas, with their penchant for parties, music, and dancing. The Amigas (the club was mainly women) included Miriam Garcia, together with her daughter Miranda, her ex, and then her current Leonel.

Barb has been in an English language book club since her early years at Nibley Park Elementary, in the mid-90s. She was also part of a French film group, sort of chaired by Jan Andrews, a local film-maker. She was especially pleased and interested to be in Amigos e Libros – the Spanish language book group!

## And more Travel

In Spring, 2009 we traveled to Folly Beach, South Carolina, via Charleston. Tonio and Andrea had rented a large house very close to the beach. There we got to know five month old Sylvia and reconnected with Amalia. We enjoy grandparenting. The Folly Beach gatherings continued for many years. One time we were in St. Augustine, Fl., another at Tybee Island, near Savannah, GA. Tonio and team would drive to these places; we'd fly in via the most accessible city. In 2011 we returned to Folly Beach in December-January and spent Christmas and New Years with Aaron and the Tonio team. That was the time I decided to run for Congress. Aaron and I spent much of the time there designing my campaign materials: Andrade, Utah, 2012 (Chapter 12). We stopped the tradition after 2016. We were starting to find it difficult to travel very long distances.

In 2007 I traveled to Boston: Martin Wattenberg, at IBM's Watson Labs, was doing great things with data visualization; we met and talked about his new ManyEyes site and software. The site closed in 2015. I also attended a conference on editorial cartooning and visited Omar Bose at [bose.com](http://bose.com) as well as Holosonics in Waterton regarding exhibits for The Leonardo. I was on foot and public transit. I purchased, on the spot, a Holosonics directed audio plate, about

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15 x 15 inches, and carried it with me. I met and talked with Amar Bose, hoping for a gift. Interest, yes. Gift, no. Bose was very fond of Thomas Stockham, a former UU prof and one of the inventors of digital sound, I was planning audio exhibits related to Stockham's work and wanted Bose to help. But he didn't. Bose died in 2013.

Whenever in the Bay Area I would try to visit Stanford. There was always something interesting, including Paul Ehrlich and Steve Schneider. I may have met Ehrlich; I'm sure I was in his office and learned of his current work and activities. I do recall intentionally meeting Steve Schneider in 2007 and walking with him on campus. He was one of the courageous scientists who really spoke to the public of the dangers and issues of climate change, as did James Hansen. Beginning in the late 90s, he worked to make the science, public, and political communities aware of climate change, including serving on the United Nations' IPCC – the Intergovernmental Panel on Climate Change.

Schneider published *Science as a Contact Sport* (2009), describing his experiences with testifying and speaking out. Earlier, when he was first diagnosed with lymphoma, he immersed himself in the study and management of his own disease, resulting in *The Patient from Hell* (2005). Both books impressed and influenced me very much. I used his advice many times in my own talks and activism:

“Know thy audience, Know thy self, Know thy stuff,” and  
“You're still alive! ...Do something!”

We talked about science literacy and communication. He was very interested in The Leonardo project and the potential for science centers and museums to help develop public awareness.

He died in late 2010, probably from the disease he so effectively battled and treated.

Some years later, after reading about Steve in Paul Ehrlich's memoir *Life!*, 2023, I learned just how prescient Schneider was. In 1976, just 30 years old, he published *The Genesis Strategy: Climate and Global Survival*. I wish I had known about Steve and his 1976 book some decades ago.



## Books, Books, Books

Knowing I was heading for retirement, and would eventually have to vacate my large MEB office, I started downsizing. I gave away hundreds of books to coworkers, students, and friends, especially Vlado Hlady.

A recently married physics undergrad, Sean Clark, who worked with me on *The Leo* and *Leo on Wheels*, took many such books, perhaps several 100, for he and his father to sell online – for his newly born son’s college fund! I packaged many topically into boxes, labelled, ready to give away. Initially, most ended up in our garage at Creekside. This went on for several years until early 2016, when the office was finally fully vacated. Thanks Michael Kay for your patience and understanding.

Nearly all my bioluminescence-related books and papers went to Edi Widder at the Fort Pierce, FL Harbor Branch Oceanographic Institution, just North of Miami. We had met and talked during the days of Protein Solutions, Inc. (PSI), many years earlier. Much of my da Vinci collection went to *The Leonardo*. In mid-2019 I sent some 10–15 boxes of technical books to Books for Africa, in Atlanta. Aaron and Tonio each spent a week with us in 2022 helping to rearrange and downsize the Creekside library. Most recently the books have gone to Marissa’s Books, a great and large store, just a few blocks from our creekside home. We’re down now to fewer than a thousand books (6–2022). There’s more ‘downsizing’ to do!

## Still More Travel, 2008–2010

The Leonardo’s Southtowne Mall ‘practice’ gig occupied me for most of February, 2008. Many of the LOW exhibits were used there, as well as the Magic Planet.

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We reconnected with Karen and Bob Sweeney in Spring, 2008 in Moab, Utah. They drove from Santa Fe to spend some time in Castle Valley, a remarkable red rock area just East of Moab. The Sweeneys had retired and relocated to Santa Fe in 2003. Bob received a New Mexico TESL (Teaching English as a Second Language) certificate, volunteering as an English teacher for the next 5 years. We viewed dinosaur footprints, did some hiking, and generally enjoyed a Castle Valley B&B.

Chen-Ze Hu and Joyce visited from Taiwan in mid-December, 2008. They were getting married in SLC – and we were their wedding party – and witnesses!

The first week of 2009 Barb was in Mexico City with sister Antonia, the guests of Fanny and her family. I stayed home to work with and at TheLeonardo. It was the last days of the BodyWorlds exhibition, and thus a very busy and important time.

Barb returned with a strong interest in painting our interiors, with bright, colorful Mexican colors. We bought bright green, yellow, orange, and – later in the year – began to paint: the south bedroom, a kitchen wall, a dining room wall, our outside breezeway. The breezeway then became a gallery for Julian's art. We even hung large Julian pieces on the outside North facing wall of our garage and kitchen – facing the creek. The paintings have easily survived Salt Lake's heat and winter cold, hanging brightly to this day (9-26-2022).

Sylvia Andrade, granddaughter number two, was born Nov. 12, 2008. In April 2009 we went to San Augustine, FL to meet Sylvia and the other Georgia Andrades.

In June the new LOW marked five years on the road with a celebration and setup in the City Library foyer. A number of LOW sponsors, all the staff, and several guests were present. I gave a little thank you speech, summarizing the activities and accomplishments of the program – in part for Peter Giles' awareness and education.

In June Barb and I went to Milan via Paris for the annual ECSITE conference. I had connected with Rinaldo Denti, son of Ennio Denti, our friend and coworker from decades before. Ennio had died of cancer. Rinaldo was a successful financier living in Switzerland with a small investment 'castle' in Milan. We knew him in 1975 as the five year old Nicola, a sweet, semi-shy boy. I had talked with Rinaldo not only about Ennio but about a possible project with The

Leonardo. I also wanted to connect Rinaldo with Mario Taddei, who was exhibiting at the ECSITE conference.

The sweet little five year old had morphed into a hard-nosed, very foul-mouthed man who bragged about talking Japanese investors into funding projects for which Rinaldo extracted significant fees. He was not pleasant. And his The Leonardo project never materialized.

From there we routed to Florence and Vinci, including doing a library archives chore for Tonio in the Basilica of San Lorenzo in downtown Florence. Then off to Paris and via train to Amboise, in the Loire Valley, to visit the remarkable museum and outdoor gardens of Leonardo's final working and resting place. The gardens contain exhibits, plaques, and signs covering Leonardo's varied interests and activities; of special interest to Barb and me was its emphasis on Leonardo's fascination with and knowledge of botany. Then it was back to Paris to see the Leonardos in the Louvre and to experience the huge science centre in La Villette. We also explored parts of Paris and marveled at the very tall buildings with hanging gardens. Then back to SLC, but with an interesting glitch:

I'd been fascinated with Amazon since that time in Leiden with Tonio when I ordered my first book on line. Amazon's Kindle Reader project was of great interest. So when the original Kindle became available in 2007, we purchased one. Although it was a bit clumsy to navigate, it was great! Dozens of books in the space and weight of a tiny, thin paperback. I loved it – so did Barb.

We had almost missed the time for checkin for our flight home. There were several passengers behind us. The plane was being held for this small group of late travelers bound for the USA. Barb couldn't get through security. The bag came back; something unallowed in it. She searched – toe nail clippers! Nope. After several searches the kind but exasperated French screener said, in French, 'You have a computer!' – 'un appareil'.

We assured her we had no computer on board or other such 'apparatus'. She asked for permission to search. We agreed. She found and triumphantly announced 'un appareil!' We had no idea. To us the Kindle was a library of books, not a computer. We learned, boarded, and made it home.

We partied shortly after our return, thanks to Fanny Blauer's 38th birthday. It was a large costume party with lots of music, dancing, food – held at the Literary Women's Hall at 9th East and South Temple, near downtown SLC.

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The Women's Hall was tended by David Blauer's old friend, Flatko – who had a small apartment on the premises. Fanny's sister, Jennie, from Mexico City, was in town. So Barb met Jennie and they became good friends; Barb would later meet Fanny's other two sisters and their mother. Crazy costumes, games, much dancing. We all loved it.

Then we hosted a July 2, 2009 party at our home – on Creekside. This was a TheLeonardo/Utah Science Center (usc) party, celebrating the formal merger of the two institutions. All usc activities, programs, and funds were embraced by TheLeonardo. We had some 50 people in our patios and backyard, on the bridge, talking, eating, drinking, and taking pictures. Peter Giles, TheLeo's Director, gave me a large framed document commemorating the merger. I was now free of the usc and The Leo, continuing only as an informal science advisor – and Peter was now largely free of me – a win-win.

In late July we headed to Portland and on to Manzanita for the second annual family get together. In late August we were back in Fremont, California to see Erma and Stephanie, Manny's daughter, and Deb, her mother. We routed up to Mill Valley and visited the Williams' former home at 516 Throckmorton, now owned by someone else. It looked very much the same as we recalled it. We hiked out to Tennessee Beach at the end of the Tennessee Valley trail, just South of Mill Valley. We loved that trail and beach and had hiked it many times. It was very close to the mv Holiday Inn, where Barb and I stayed many times while the Williams were living on Throckmorton.

## Reunions

2009 was our year for 50th high school reunions. We had not attended our previous high school reunions. Why now? We had the time and money. We were indeed curious about all those close friends we once had. Barb wanted to revisit the region where she grew up, especially the Occidental-Sebastopol ranch and the Healdsburg family farm.

We routed north from Fremont to Gualala, Ft. Ross and then towards Healdsburg. Barb's reunion on August 22 was held, of course!, at a winery fairly close to Healdsburg. Barb grew up with grapes as a pre-teen. Julian was involved in grape growing and wine making in their early years in the Healdsburg area. She reconnected with two high school friends, Marilyn Bruner Howell and Pat Nardi Carroll. I didn't meet any old boyfriends. There was this six foot, lanky fellow she went out with in high school that I wanted to meet! We visited her always ebullient brother Rhys in Sepastopol.

While in the Healdsburg area, Barb wanted to revisit her childhood homes and haunts.

We saw the one room schoolhouse near Sepastopol on the way to the Williams' farm. The school house was still standing. We retraced Barb's long walk to the Sebastopol ranch. It had a dirt road/driveway which ran down the hill to a gated connection with a local highway. As we walked in Barb pointed out the foundation of their former home. She also spied an old persimmon tree, and burst into tears. She recognized it from some 60 plus years earlier. She recalled playing on the steep driveway with Rhys and with her sister Antonia.

Adjacent to the ranch was another property, owned by the Kasselbohms. They had a home in Berkeley and small children, Barb's playmates. Their son, about two years younger than Barb, presented her with a hand made engagement ring – her first and only engagement ring! One summer weekend they took Barb to their place in Berkeley – they had a tv! Walter Kasselbohm worked in computers – perhaps a large UNIVAC system – with the Marchant company. This was in the early 50s. He showed Barb and his kids the large computer he worked with.

Many years after the Williams relocated to the Healdsburg area, the Occidental property was later willed by the then owner to God; it became a site for hippie squatters and philosophers.

We drove on to Healdsburg and the area near Fitch Mountain, where the Williams ranch was located. Barb navigated us to the ranch site. The home and structures were all gone, replaced by a subdivision that looked like a set for *The Truman Show* (an old film). Barb was so disappointed. Contours and gullies remained. We walked the open property around the subdivision. The few people we talked with had no clue as to the history of the area. No surprise.

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Then to Healdsburg city and Matheson Street to the former Williams home. It had a most interesting yard. I had met Barb's family there probably in 1963 or so. I was impressed by the sheds, studios, workshops behind the house, where I had talked with Rhys and with her parents, especially Julian.

Barb had showed me around Healdsburg and introduced me to the Russian River and pointed out Fitch Mountain, east of town. We also saw the public library where she worked in high school. A great reconnection to Barb's family and surroundings.

A month later we were back in Fremont for my 50th reunion. We visited Erma in Union City, experienced her wonderful nearby park and lake. I drove by 10th and I Streets to see the former Bert's Market – now the La Tendita Mercado.

I had not attended any previous reunion. I reconnected with the full bearded Igor and his Shirley and with several other literary friends – Ron Roe, Robert Kelly. I had tried very hard, but unsuccessfully, to contact Ken Brown, probably the most influential to me of the high school group. Barb met Cathy Swoda, the woman I phoned (on her wedding day) to date after Barb and I broke up in December, 1965. That was just before the 'miracle' happened. We met Cathy's current and second husband, Ron Chandonais. They're in the middle of Montana running a tourist ranch. Barb and I went up to Los Altos to see Tom and his Judy. We had met at Berkeley and then later on at San Jose. Tom also had a great influence on me. Then back to SLC.

Thanksgiving, 2009 was in the Boulder, Utah home of Suzanne Winters and Bob Ramsey. Antonia and Paul Manda were with us. We stayed at the small and perhaps only motel in Boulder, had a magnificent paella dinner, hiked in the Escalante area, seeing dinosaur footprints pointed out by Bob, and spent some time in nearby Capitol Reef National Park. Bob and Suzanne had built their spacious home on the tip of a large mesa, just East of 'downtown' Boulder, with magnificent views towards the Hole in the Rock area and the Burr Trail.

Christmas was spent at our home with the Hladys, Jae and Brinda Jaikumar, and Shahpar and her mother Malek, her uncle Mansoor, and Shahpar's niece Bahar Edrissi. Barb and I were part of the Kopecek's annual post Christmas Day gathering, together with Aaron, his Thai friend Amy, Hladys, and Jarmila Janatova.

Aaron and Amy had somehow made it from Portland through southern Canada and south to SLC on semi-bald tires! We got a new set of tires in SLC before their winter drive back to Portland. New Years was with Aaron and Amy, including a great day cross country skiing.

We celebrated New Years via Skype with Tonio, Andrea, and Amalia, and with nearly 6 week old smiling Sylvia.

2009 was a very full year!

## 2010

The year began with much TheLeo STEMworks activity – and of course Barb's birthday.

In late February we hosted Barb's Berkeley roommate, Sandy, and husband Bill Berry, who had come to SLC with another couple for a few days of skiing. We introduced them to our remarkable new library.

In early March we were with Aaron in Joshua Tree National Monument for a few days. Then it was on to Arsalans. Aaron played Ahmad's keyboard, and we all played at Karaoke. Then Barb and I went to the Getty Villa with Arsalans for a one day visit.

Later in March was the 70th birthday symposium and celebration for Henry Kopecek, as part of the Drug Delivery conference activities in SLC. Barb and I participated in a recognition dinner with many old friends.

Chen-Ze and Joyce Hu, now married, visited in May, from Taiwan.

I did a STEMworks Energy workshop at a local private middle school in May. This was the most fun of all the energy workshops I'd done. I had the O<sub>2</sub> and CO<sub>2</sub> sensors as a focus, getting the kids to inhale and exhale near the sensors, in a competition, showing that a small classroom of exhaling kids results in greatly increased CO<sub>2</sub> levels – no surprise to me but a minor revelation for all of them.

We participated in Kanab's Amazing Earthfest event again, doing a small energy education exhibit in the Kanab Library.

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Barb met up with Becky Rabanal and Karen Sweeney in late May in Denver for a few days of talking, reminiscing, and touring. They found a region of mosaic art on a city street that enthralled them.

In May and June, preparing for Barb's project on writing her PCV memoir, we scanned dozens of photos and related materials she and PCV partner Becky had gathered in Colombia.

We made it to Portland – Manzanita again – in July, this time staying at Susan's Beach Cottage. The property had a kids playground, a piano!, and a fenced backyard. The kids and the Manda dogs loved it. The piano was a great feature. Aaron and Tonio always jam when there's a piano or keyboard present – and the girls chimed in.

In August we went to Fremont to see Erma and Manny, then routed to Petaluma to stay in its 'Paris' Metro Hotel. We visited the Tea Room Cafe, owned by one of the Roth's daughters, Maggie or Jessica, whom Barb knew from her growing up days – but we didn't connect with her. Rhys met us in Petaluma, we had dinner together. We then rolled to Santa Cruz, I think, and Ano Nuevo Park to hike and see the elephant seals. From there it was down to San Luis Obispo and I guess straight home.

Late August was Luc Hibbs' wedding to Linze at Grand Targhee resort. Barb and Antonia Manda traveled to New York in September to see their Aunt Edna and cousins.

In October we were off to Hawaii to see Fanny and the Blauers, who were residing and working there for two years. We also visited the big island of Hawaii. The official catalyst for the trip was the ASTC meeting in Honolulu, where I'd organized a session focused on our Flexibits and STEMworks activities.

The Decatur Andrades were in SLC for Thanksgiving, as was Aaron. Tiny Amalia and Sylvia made breakfast one morning, propped up on stools to reach the kitchen counters. Andrea was pregnant with Josie. Our friends Brinda Jaikumar and Paola Neyme were also there – and also pregnant!

The SRA, Society for Risk Analysis, held their annual meeting in SLC. I'd organized a session called Engaging the Public on our risk education interests, involving Paul Slovic and Frank Drews, a psychology professor at the utu. We discussed 'psychophysical numbing' (Slovic) and adolescents and decisions (Drews). Mary Anter and I discussed TheLeo's related activities and plans. It was one of my last professional conference presentations.



We spent Christmas days hosting a large group, including Kopeceks, Hladys, Neymes, Jaikumars and Hibbs.

Another very full year.

## 2011 was...

off to Portland for New Years via Baker City and its Geiser Hotel. We spent a night with Jill and Scott at his ‘cabin’ in Government Camp at the base of Mt. Hood. We discussed the problems with private land ownership, and enjoyed some snow walking. Then to Portland for a stay with Mandas. On to Corvallis to see a friend of Barb’s who’d retired there in a very modern, energy sustainable, new retirement facility. Then on to Yachats. We stayed just south of Yachats at a B&B right on the coast, The Oregon House; then it was on to Brookings and Healdsburg. We visited Pat and Marilyn, Barb’s high school friends, and did a brief look at her family home and library in Healdsburg. Then on home via Morro Bay – where we saw Rhys’ friend Janet. We then headed due East to Zion National Park before heading in to SLC.

Barb and I celebrated our 45th wedding anniversary that February 4 at Asilomar, in Pacific Grove. We liked the area so much, we continued to winter in Pacific Grove from then on. During this trip we took Erma to several sites for her upcoming 90th celebration. We settled on a Denny’s in Hayward and a date of March 26. We returned some five weeks later to work on the 90th. We had let all the local relatives and friends know about the big celebration – there was a great turn out.

After all the goodbyes, we headed south to see John and Melody Taft’s botanical garden near Ojai. The Tafts are friends of Hugh Bollinger. They had just returned from a trip to Africa. Melody had prepared a delightful outdoor lunch. John eagerly took us on a property and garden tour, including rough riding in his jeep around the property.

On April 11 granddaughter #3 arrived – Josephine. We met her a month later in Tybee Beach, GA.

## Kanab's Amazing Earthfest

Kanab's Amazing Earthfest event was in mid-May. Rich Csenge, the event's founder and director, asked me to speak at the opening Invocation – held in a beautiful red rock amphitheatre on the property of Best Friends Animal Sanctuary, on the north side of Kanab. It is a beautiful, majestic, and inspiring setting. My talk was called: *TIME* – Perspectives, Patience, and Action. It was a call for environmental, planetary sustainability in a setting evoking geologic, very long, time.

Fitting in with my interests in citizen empowerment and political involvement, I set up the Visual Values Project posters and materials in front of Kanab's historic Crescent Moon theatre, where the Earthfest documentary films were being shown. Titled Values Matter, People Matter, Candidates Matter, the posters and associated work sheets allowed the few interested folks there to assess their candidates – the people they knew – as to their suitability for political office.

We had, after considerable study from 2011–2012, selected twelve 'personality' traits and qualities, which we called 'Values' or 'Factors', and developed a metric to estimate such for public figures. We then plotted those estimates ('data') on twelve axes Radar or Star or Rose plots for display, analysis, and comparison. We experimented with the placement of the axes so as to facilitate the emergence of characteristic, identifiable patterns. We had sample plots on display for Senator Hatch and other local political figures.

## Stabilizing 949 Millcreek Way

On the immediate north side of our home was a very large concrete slab, from the house wall to the bridge and the south bank of Mill Creek. The house and slab was safely well above the creek level, but the slab was cracked in several

places and really needed repair. After a few inquiries we engaged a man of South Pacific roots to do the job – we called him Sam, the Patioman. I never did learn his last name. Sam was perhaps in his sixties, had obviously worked hard, really wanted the job, and convinced us he was up to the challenge. He and several sons began in mid-June by simply destroying the existing, semi-deteriorated slab, and hauling it away – all by wheelbarrow, through our narrow gate on the west side of the property.

We were of course concerned with the stability of the soil and slab – not wanting it to migrate north and into the creek! He built a keel-like structure for the new slab, anchoring it deep into the soil. He built forms to guarantee the new concrete would interface smoothly with the existing bridge. He ordered the concrete, staged and staggered its delivery – all via wheelbarrow brought in through that narrow west gate. We paid for concrete and all other supplies as they were acquired and used.

Sam and his two boys worked very hard. I could tell Sam was often in pain. One time he asked if I had any aspirin. I said I had ibuprofen – he took a small handful and swallowed them all in one dry gulp. I cringed.

One time he appeared with his two young granddaughters. Their mother had to work and Sam was delegated to care for them today. He said they were very good kids, no problem. And they were. Barb put on her teacher persona, we set up a little kids desk for them, had magnetic letters to stick onto the metal garage door, paper, crayons, and kids books for their entertainment and education. Cute and beautiful kids. One even played the piano with our little stuffed doggie. We had them for two days.

We had arranged with Sam for the concrete to be tinted reddish, to match the sandstone slabs we had around and near the patio. When he had finished much of the pouring, he began sprinkling red powder onto the still wet slabs. Interesting. He and his boys then pounded and stomped the red pigment into the concrete. There were great clouds of red powder in the air. They were not even masked while doing this. The concrete transformed from its dull grey to a reddish pastel tint that matched what we thought we wanted. They even textured the slab to sort of look like sandstone tiling and to make it less slippery. Eleven years later the slab is stable, the color secure; we've been very pleased with the job. We haven't heard from Sam or his granddaughters since the job was finished. We hope they're well.

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There wasn't much land between the end of the new slab and the edge of Mill Creek. So I proceeded to develop an interlocking concrete block bank stabilization project. I cleared a footing for the blocks on top of some existing concrete and rocks down at creek level. Then our little red Subaru and I began hauling the blocks from the dealer, one heavy trip at a time. I placed them on each other in a tiered, slightly sloping profile, filling the holes in them with dirt, pebbles, and sand. I must have made ten or more Subaru trips in October and November to complete the new wall. There was now a small dirt space between the end of Sam's slab and the concrete block wall. Barb planted some tall grasses in the narrow space, which filled out and looked very nice the following spring.

Slab and wall finished; creek bank stabilized. All good, except for my growing back aches.

## More 2011 Adventures

After Sam's Slab but before the bank wall, I celebrated my 70th birthday by going tandem paragliding with Dylan Neyme. It was a very short, windy flight at the Point of the Mountain paragliding park. Exhilarating. Thank you, Dylan!

In late August we were back in Oregon – Manzanita, and Neahkahnie. We stayed in Neahkahnie Village rather than Manzanita. The Sweeneys were with us. Tonio and his team didn't make it out that year. Scott arrived by bushwacking down from US 101, after hiking the Neahkahnie Mountain trail. He encountered a wasp nest on the way down, ending up with a well bitten, very red, painful back.

In late August, after a day or two in Portland, we drove northeast towards Missoula to reach and stay in Philipsburg, MT. The next morning we drove to the ranch location of VoteSmart, an impressive group founded and directed by Richard Kimball. He ran against John McCain for Senate in Arizona in 1986. He lost. He described the campaign process to prospective voters:

'Understand what we do to you. We spend all of our time raising money, often from strangers we do not even know. Then we spend it in three specific ways: First we measure you, what it is you want to purchase in the political

marketplace – just like Campbell’s soup or Kellogg’s cereal. Next, we hire some consultants who know how to tailor our image to fit what we sell. Lastly, we bombard you with the meaningless, issueless, emotional nonsense... And whichever one of us does that best will win.’

Disgusted with the political process, he founded VoteSmart – with the slogan Facts Matter, in 1992. And they did matter back then, although the political process was already badly eroding. I was impressed by his organization, its goals, and his vision. I wanted to meet him. So we did. We found the large, remote ranch, parked near some major building, went in, and asked for Richard.

It turned out to be a very difficult day. His right hand person caring for the ranch and property had just died of an abrupt heart attack. We met the man’s wife and offered our condolences. I met and talked with Richard and was impressed by what he was trying to do with very limited resources; nearly all his staff were barely paid summer interns, just working for room, board, and a vision. We had donated some money to VoteSmart – we would donate more. There was a lovely cathedral-like little library and a small lake-pond on the property. A beautiful spot.

From there we drove south on I-15 to Monida, then east on a graded road into the Centennial Valley. About 28 miles in is the Red Rock Lakes Wildlife Refuge and the ghost town of LakeView, which has been lovingly and thoroughly reconditioned by John and Melody Taft – Hugh Bollinger’s friends. We later learned that the cattle ranch we drove through to get there is owned by Koch Industries, the private corporate wallet for the Koch Brothers’ climate denial and related Libertarian political projects.

We were there by the invitation of Mary Tull, now with the College of Humanities of the uu. Mary directed The Leonardo until replaced by Peter Giles. The Tafts had donated much of their Lakeview land and buildings to create the Taft-Nicholson Center of the uu College of Humanities – a retreat in the near wilderness for scholars, students, writers, and scientists to work, study, and understand nature and the planet. Barb and I were part of a small group with connections to uu.

We were accommodated for one night in a small cottage near the meeting and dining commons.

John and Melody were also on site at the same time. We had great discussions. The next morning John took us on a fast tour of the grounds in his

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ubiquitous and exciting Jeep. He kept stopping to look through his binoculars for eagles and hawks. Barb sat right behind him, enthralled with it all. We saw the lakes, wildlife, ruins. I climbed a fire watch tower in central LakeView with John – a magnificent view of the surrounding landscape. To the south are the mountains whose ridge line is the Idaho-Montana border, running roughly east-west at that point. LakeView had been a stagecoach stop between West Yellowstone and points to the west. The Tafts had beautifully restored some of the original buildings, including a saloon and bar, with saddles on the bar stools!

We then continued east on the same graded road, reaching pavement near Island Park. We quickly realized we were rolling on a partially shredded tire, thanks to all the sharp small outcroppings on that long ‘graded’ road. We stopped. We actually had phone service and GPS access. AAA bailed us out via a small shop north of Island Park. We found a room on a river nearby while the AAA man found us a tire. Then we routed up and east again to West Yellowstone and into the Park. We visited Old Faithful, an adjacent visitor center, walked among the pools and geysers, and then back west to head south again. We took a detour on Mesa Falls road to see the beautiful falls and geo-volcanic features – on the way, more or less, to Hibbs Wedding #3 – Jon and Ginger, in Victor, Idaho, Sept. 2–3. The oldest Hibbs was the last to wed. We did a hike in Teton Canyon north of Victor, with a great view of the Teton peaks looming to the east.

A magnificent day for a cool wedding. Ginger’s 100 year old grandfather showed off his shotgun, documenting their sort of ‘shotgun wedding’. Baby Tess was already on the way! Jon and Ginger had been together for many years. Tess just helped make it official – not the shotgun. All the Hibbs friends were there, including Francoise’s French family members. And then we headed due south to SLC and home.

In late September we celebrated John Hibbs’ birthday and official retirement near Capitol Reef, at a campground on the beautiful highway between Torrey and Boulder. And, a few weeks later...

*The Leonardo finally opened* – October 6, 2011, after several rebirths and an overall gestation of some 40 years! Persistence. During that opening weekend I ran into Mara Hammer – and her three now well grown children. We discussed old times at PSI and bioluminescence. Later that month it was back to Portland to see Aaron participating in a Joni Mitchell tribute concert with friends.

In late October the Occupy movement had spread even to SLC. On October 31, Barb and I encouraged and hosted our close friends – Hladys, Hibbs, Kopeceks – to visit the Occupy encampment with us – at Pioneer Park just across the street from Tony Caputo’s Italian restaurant. We’d all been talking about the movement, but with no first hand awareness. We were all impressed with the organization, commitment, and sympathies.

And at the end of 2011, we were off to Folly Beach – this time with Aaron – to conclude the year and welcome 2012.

## Barb’s Community Garden, 2012...

Barb and Lisa McDonald learned that SL County was receptive to a proposal for a community garden in Scotts Ave. Park, a few blocks west of us. Mill Creek runs through the park. The park was re-designed as a flood retention facility and pond after the mid-80s flood experience. Barb and Lisa had to secure signatures and endorsements from neighbors to show the County that there was sufficient local community interest in a public garden. In the cold months of February and March, they secured enough interest to submit the proposal; the County agreed and authorized the land and the project. We began to work – especially Barb, as I was campaigning for most of 2012.

The MillCreek Community Garden was indeed founded and implemented. There was a festivity in Aug. 2012 with Mayor Peter Corroon and other officials. In November the entire garden gathered for a celebration of the first season! Barb had a plot in the garden for the next seven or so years. The garden continues...

I did take time to attend a UU Stegner Center conference in early March: *Silent Spring* at 50: The Legacy of Rachel Carson. The meeting reinforced my interest in Carson and her remarkable book. At the meeting I purchased a 2005 book by P. Coit Murphy, one of the speakers, titled: *What A Book Can Do: The*

Publication and Reception of *Silent Spring*. Perhaps that had some impact on my wanting to write a significant book.

I fully retired July, 2012, with Emeritus status, but maintaining my MEB office for several more years. It was now a good time to conduct a unique experiment in political ‘science’ (next chapter). But first, party!

## 50th Friendship Party, Wasps, and Real Stories

Barb and I liked commemorating birthdays and anniversaries – we liked parties and friends. So in early 2012, probably thinking of Barb’s 70th birthday, and our 46th anniversary, we realized we met some 50 years ago in that UC-Berkeley library. And who knows how much longer we have together, so let’s celebrate that 50 years of love, friendship, marriage, and friends – and with our two great kids and three cool granddaughters.

We knew and loved the Mill Creek Inn in Mill Creek Canyon; we’d celebrated Barb’s 60th birthday there a decade earlier. We knew Sasan, the owner-manager, and his mother, Shahpar Ghodsi, was one of Barb’s best friends. So we booked the Inn for the afternoon-evening of July 31, 2012 – some 50 years after Barb and I ignited our relationship and friendship with that chance mid-1962 encounter at the Cal Berkeley Student Union and the magic July 4 letter that started our courtship. And we invited nearly everyone we knew. There would be a great dinner, drinks, dancing, a few short speeches – a friendly celebration.

We set the party right after our Manzanita gig, so the Decatur Andrades could all participate. The Hibbs came with their two wonderful grandkids, Luc and Juliette (Amalia and Sylvia’s ages). Fanny and David came with their Danny and Juliette. And many, many more. We dubbed the event a *Gracias a la Vida* party. We had a DJ and his sound system for the event. He was recommended and recruited by Sasan at the last minute when it was clear the Inn’s sound system would not be appropriate for the event we’d planned. We had put



a playlist together, but the DJ brought his own lists which greatly enhanced the event.

The highlight, for me, was Fanny Blauer and Aaron Andrade singing and playing ‘Gracias a la Vida’, a song dear to Fanny and Barb and to the Latinas and Amigas in their book and party group. We decided on it at the last minute. Fanny and Aaron had very little time to practice – and did a fantastic job. An even cooler highlight was the kids dancing, Sylvia and Luc Hibbs, with his cool cowboy hat, really clicked. They danced beautifully, Sylvia spinning Luc around on the dance floor. We all watched and cheered. Much later, in a discussion with his grandparents, Francoise quoted Luc as saying:

‘She’s perfect!’

I had organized an evening surprise for Barb. She was a great fan and supporter of RDT, Salt Lake’s famed Reperatory Dance Theatre. I had won a silent auction earlier in the year at an RDT concert and fundraiser, for a subset of RDT to perform at a special private event. The July 31 date synced with RDT’s schedule. Linda Smith, the group’s director and one of its founders some 50 years earlier, attended, with her husband Ivan, and four of the RDT dancers – all known to Barb. It was marvelous. Barb was surprised. RDT was introduced to a large group, most of whom had never been to an RDT performance. We made short speeches, received cards and some bottles to mark the event, and everyone talked and danced. A great evening.

It was several years later than Shahpar told us that her eldest son, Sasan Moatamad, the manager of Mill Creek Inn, had been having some serious medical issues and had passed away. I felt terrible, as I had criticized him the afternoon of July 31 regarding the sound system.

The Decatur granddaughters also had a traumatic experience a day or two later. The family was staying with us, in our basement bedroom. I set up our tent in the back yard for Amalia and Sylvia to camp. We spent some time in the tent together. Sylvia wanted a story. She perceptively criticized my story and telling skills, with the serious:

‘Tell me a real story’.

She did not want to hear about Barb’s duckling rescues or other local experiences. She wanted a ‘real’ made-up story.

They stayed with us for several days after the 50th celebration. So on a very hot August 1 day, we were all on our ‘breezeway’ patio, just above the creek,

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eating and talking, when Amalia began rocking the metal chair she'd been sitting on. In only a few minutes of rocking, making a sound and vibration in the underlying concrete, she excited a nest of ground wasps. We didn't even know they were there. Out they came defending their territory. Straight into Amalia's and Sylvia's hair – stinging.

The kids knew wasps; they'd been told that if attacked, to stand still, to avoid any further provocation. That clearly did not work. We quickly exited the patio into the house, with a few wasps trailing in. We extracted perhaps 5 from Amalia's hair, several from Sylvia's. I was also stung, as were several others. The next day we went to Tracy Aviary, where Barb had been volunteering. It was over 100 F, extremely hot. Sylvia got sick, threw up, likely due to wasp-induced PTSD. She got over it and they were all ok. The number of stings much later became a cool story and sort of a measure of resilience.

But, a night or two earlier, Andrea, reading in our basement bedroom with Tonio, felt and saw a large spider crawling across her body! She had the sense to let it crawl off of her before jumping out of bed, shining her iPad screen on it, and confronting the intruder. We had spider traps downstairs, but... She immediately went on line and identified it as a large brown recluse. This is a known toxic spider semi-common in our part of the planet. She survived fine, no bite.

A little trauma, lots of stories to tell and embellish, clearly a memorable visit. But, between the spider, the wasps, and the discomfort of our underground guest bedroom, they haven't stayed with us in Salt Lake City since that time. Sadly, but understandably!

Time for a new adventure...

# CongressQuest – For A Sustainable Future

*Introduction • Clueless George – 9-11-2001 • Huntsman and BRAC  
• Stegner, McKibben, The 'Kid', Gore's Nobel • Bill Barron, CCL, Hans  
Ehrbar, and Mike Noel • Tim DeChristopher • Beginning The Run •  
Ballot and Platform • District 2 • Energy • Campaign • Debates and  
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Nov. 6, 2012 – Election Day • Academic Apathy • Was my One Year  
Experiment Worth the Time and Effort? • Project 104 • UPEC – Utah  
Population and Environment Coalition • And Now What? • Introduction*

**M**Y INTEREST IN Science, Society, and Politics began early – perhaps with Bogosian's philosophy course at SJSU back in 1965. That interest was reawakened in Utah via Utah CLEAR and the Technology and Society course founded by deNevers. It continued during my Dean years via interactions with legislators and the Governor. It expanded with the growing awareness of and concern about CO<sub>2</sub> emissions and impending climate change in the late 90s and early years of the new 21st century. During that earlier time my actions were limited to some letters to the editor, comments to press and public, and content in my own courses and talks.

The need for science in the political process and for bridging science and humanities was a key concept for the *Science without Walls* telecourse. My talks in the early 2000s all emphasized environmental issues, including energy sources, air pollution, even the hydrogen economy. The Leonardo project also had a strong environmental focus, including my early concerns with climate change. But it was really only in my early 60s, from about year 2000 and beyond, that I really began to be involved in the political process.

## Clueless George – 9–11–2001

I was very disappointed with George Bush the younger being ‘elected’ President in Nov. 2000. Had it not been for Ralph Nader’s Green Party votes, and for a Supreme Court decision which can be argued was politically biased and improper, Al Gore would have become President. And the Environment, and much of the impending climate change problems, would have been effectively addressed. Monica Lewinsky and Bill Clinton, via public disgust, were also responsible for the Year 2000 election results.

Barb and I recall a *Saturday Night Live* skit in the early days of the 2000 campaign: Barbara Bush and husband George Senior are discussing all the mental limitations of their young son – musing they might do the nation a great service by preventing little George from running, even if it required ‘taking him out’. It was quite hilarious and to the point. C- students shouldn’t run for President.

But little George did run; Clueless George (the title of a wonderful Pat Bagley cartoon book) became President. Some eight months into his first term, on 9–11–2001, four terrorist-hijacked commercial aircraft flew with full gas tanks to function as suicide bombs to weaken and create chaos in the USA. Two of the four hit the World Trade Center (WTC), causing the entire structure to collapse, killing 3,000 people. One hit the Pentagon. The fourth, originally bound for the White House area, was attacked from within by the terrified but courageous passengers and crashed in a field far from its intended target. All aircraft occupants died.

Barb and I were preparing to go to work that morning. We heard something on the radio, I immediately turned on the tv, and saw the second plane hit the second WTC tower. The world was shaken. Terrorism had taken a new escalation. The War on Terror was declared and initiated, by Clueless George and VP Dick Cheney (see the film *Vice*). The world would never be the same. Suddenly we were 'creating our own realities'. Little George urged us, not to sacrifice or conserve, but to shop – to enhance our economy. He understood almost nothing, Cheney was only slightly less ignorant. International economic, political, and religious concerns were far beyond them. We were soon at war with Iraq, Afghanistan, and, almost, Iran – but not the country of citizenship of the 9-11 terrorists – Saudi Arabia. The Bush's kept on with their personal oil-dealing with Saudi Arabia! A horrendous terrorist disaster was followed by a Bush Presidency mess.

Clueless George was actually reelected to a second term in 2004, continuing to mis-manage the country and the world. Towards the end of George's second term, the economy was collapsing, in large part due to his Middle East war adventures and the un- and mis-regulation of the entire financial sector, including home mortgages and high speed financial magic. The economic meltdown helped usher in the Obama Administration in 2008. Obama was smart, competent, took advice, learned, and didn't suffer from rigid, mis-ideologies – and neither did his VP, Joe Biden.

## Huntsman and BRAC

Jon Huntsman, Jr. was elected Governor of Utah in late Fall, 2004. Huntsman was re-elected in fall 2008 for a second term, the same year Obama was elected President. Each man was elected by a quite large margin. Both Huntsman and Obama were well aware of climate change, greenhouse gases, and the world's dependence on fossil fuels. And so was I.

The 2008–2011 years marked protests, uprisings, and actions across the globe, prompted in part by the 'Great Recession' and meltdown starting in 2008. The 'Arab Spring' occurred in early 2011; Occupy Wall Street (ows)

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started in late 2011 ('We are the 99%'). The 'global mood' was protest and activism – and has continued.

My political education was enhanced by the 2004 election of Jon Huntsman as Utah Governor.

Huntsman was smart, literate, and aware of socio-political issues, including greenhouse gases, fossil fuels, and climate change. Huntsman announced in 2006, during his first term as Utah governor, a state goal to increase energy efficiency by 20 percent in 2015. In his second year as Governor, Huntsman launched and organized the Governor's Blue Ribbon Advisory Committee (BRAC) on climate change: 8-25-2006. BRAC was chaired and led by Jim Steenburgh from the UTU Meteorology Dept. It included faculty from UTU, USU, and BYU, among other members. Rob Gillies, USU, became a major spokesperson for climate change education and information.

The BRAC report was issued in Oct. 2007. It was succinct in its conclusions, comprehensive in its analysis and sources. But it was then rapidly forgotten and almost ostracized, because... the Utah Legislature was and is a largely far right, climate denial group. They opposed Jon Huntsman and BRAC. A number of semi-popular, outspoken, and denialist members, in particular Mike Noel of Kanab, led the charge to oppose all state efforts related to addressing climate change. There wasn't a lot Huntsman or his administration could really do.

Huntsman campaigned for the GOP Presidential nomination in 2008. At that time he said in the *New York Times*:

"I was re-elected with almost 80 percent of the vote in bright red Utah as an environmentally forward-leaning Republican".

He also said:

"Republican candidates chuckled at a question on climate change – as if they had been asked about their belief in the Tooth Fairy."

Huntsman recognized that his GOP was changing. He soon dropped out of the 2008 GOP presidential race. The next year, the first year of the Obama administration, Jon Huntsman became US ambassador to China, leaving the Utah governorship in late 2009 in the hands and in the constrained cortex of Lt. Gov. Gary Herbert. Herbert served for the next 10 years! He was a strong conservative and more or less disinterested in climate change and BRAC. Unfortunately, BRAC is also the abbreviation for Base Realignment and Closure – a topic very dear to the Utah governors and legislature.

As Herbert was not interested in bucking the legislature, the Huntsman BRAC Report was quietly shelved and no longer a topic of discussion. It was largely and quickly forgotten, even by the *SL Tribune*. All the serious work and thought that went into the report was simply ignored.

The Utah scientific community, first inspired by Huntsman's interest and initiation of BRAC – and by Obama's election and his awareness of climate change, then became disillusioned by the entire political process. With the exception of Rob Gillies, the BRAC team more or less thought 'to hell with politics, especially in Utah'. A small set of faculty at BYU and UTU continued the effort to bring climate change to the public conscience, especially Hans Ehrbar, Phil Emmi, Barry Bickmore, and me, as well as Rob Gillies.

## Stegner, McKibben, The 'Kid', Gore's Nobel

As I began phased retirement in 2004, at the age of 63, I wanted to get involved and DO something. I now had the time to begin functioning as an informed, responsible citizen.

In about 2008 I began to start to get involved in issues, politics, candidates. Fortunately, in March, 2008 the UTU Quinney Law School's Stegner Center held a major symposium: Alternative Energy – Seeking Climate Change Solutions. The program, largely planned and organized by Lincoln Davies, was comprehensive, inspiring, and far-reaching. The program booklet included a quote by the Center's namesake, Wallace Stegner:

“Our large-scale burning of fossil fuels endangers the atmosphere in other ways than pollution...

Through thinner and thinner air we labor toward our last end, conquerors finally of even the earth chemistry that created us.”

I attended and took in the entire meeting, including Bill McKibben's final keynote: 'Building the Climate Movement – Just in Time'.

The kid sitting next to me in that large lecture room looked at me and asked:

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“Did he really say that – risking arrest to simply be heard?”  
We just happened to be sitting next to each other.  
“Is that really what’s needed?”

The speaker had reaffirmed his statement:  
“Not just arrest, but possibly physical danger.”

That ‘kid’ was Tim DeChristopher; we self-introduced each other after the discussion.

He was an economics undergraduate at the UU. I said I am a professor of engineering, soon to be retired, concerned about the planet. That was all.

Later, in December, he made history by bidding in a BLM oil lease auction for parcels in the Moab area. It was a bid in protest of the Bush administration’s Interior Department actions. Tim was arrested and charged. See the documentary film *Bidder 70*, 2012, for the details.

That same month and year ex-Congressman Bob Inglis proposed a fee and dividend plan via an op-ed in the *New York Times*. The brightest event in late 2008 was the election of Barack Obama as President.

Back in 1976, newly elected Tennessee Senator Al Gore held congressional hearings on global warming. He published his seminal *Earth in the Balance* in 1992. In 2000 he should have become President-Elect, but the Supreme Court ruled against him in favor of little George Bush – a real stolen election. But Gore continued to work in behalf of Planet Earth. He ‘starred’ in his ‘slide show’ documentary *An Inconvenient Truth* in 2006. He and the Intergovernmental Panel on Climate Change (IPCC) received the Nobel Peace Prize in 2007 for their work on climate change and greenhouse effects.

The film and the Nobel Prize inspired Marshall Saunders in 2007 to organize the Citizens Climate Lobby (CCL), a national lobbying and education group focused on a carbon fee and dividend plan to help curtail greenhouse gas emission. In 2009 CCL held its first Washington, D.C. annual conference to work on CCL’s ideas and proposed legislation.

The years 2009–2010 were important for popular books and events related to climate change and environmental concerns, including:

James Hansen’s *Storms of My Grandchildren*, 2009,  
Stephen Schneider’s *Science as a Contact Sport*, 2009, and



Naomi Oreskes' *Merchants of Doubt*, 2011.

The right wing, anti-science GOP was catalyzed by the Koch Brothers, wanting to 'save' capitalism and democracy during this time. They advocated an ultra-libertarian, small government agenda, and poured money into the GOP and even the Bush campaigns. Their activities were revealed in a 2010 *New Yorker* piece by Jane Mayer. She thoroughly studied, summarized, exposed, and critiqued their agenda and actions in her 2016 book *Dark Money*. The book opens with:

“Oddly enough, the fiercely libertarian Koch family owed part of its fortune to two of history’s most infamous dictators, Joseph Stalin and Adolf Hitler.”

On April 20, 2010 British Petroleum's (BP's) Deepwater Horizon oil drilling and extraction facility blew up, killing eleven oil workers and spilling millions of gallons of oil into the Gulf. The leak continued for months, with no end in sight. Rachel Maddow's Fake President piece of June 17, 2010 (see <https://www.youtube.com/watch?v=DUKlhK0leI>) effectively addressed the problem and the issues. Obama's later 2020 memoir, *A Promised Land*, recounts the work of Energy Secretary Steven Chu in helping and getting BP to more effectively address and finally stop the massive leak.

## Bill Barron, CCL, Hans Ehrbar, and Mike Noel

Bill Barron and I probably first met in early 2010 at the Utah Legislature. We each testified in a committee meeting opposing HJR 12. He was planning to attend the CCL Washington DC conference that June. It included only 25 committed CCLers. The meeting was followed by a Climate Advocate Training; Bill returned home and organized the Salt Lake/Utah chapter of CCL. He'd been considering running for office. He ran for US Senate, as an independent, in 2012 and 2016. He also ran for US House in 2014.

HJR 12 and 21 were bills, drafted in 2009 for the 2010 Legislature, intended to thwart Governor Huntsman's initiatives on climate change and

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greenhouse gas emissions – and intended to castrate the BRAC report. Although Bill, Hans Ehrbar, others, and I all worked to stop the bills, Mike Noel, a Kanab-area representative, led the charge for both bills, which easily passed via the GOP supermajority.

Hans Ehrbar is a tall, stately, well bearded economics professor, now retired. He was the region's largely lone critic of unbridled capitalism, growth, and industrial development – a Marxist scholar and socialist. Hans organized a conference on UU campus in Feb. 2010. The keynote speaker was Tyler Volk, who'd just published a little tutorial book, *CO<sub>2</sub> Rising*, 2010. Much of the climate science community at the time were concerned with 'informing' the public as to the 'science', expecting rational folks to change their minds when exposed to the facts – to the 'science'. I had produced a small CO<sub>2</sub> principles kit – a CO<sub>2</sub> molecule with springs representing bonds, and a discussion of the molecule's IR absorption characteristics, the basis of CO<sub>2</sub>'s greenhouse activity. I had tried to use it with Mike Noel, who advocated that the more CO<sub>2</sub> the better for plants. I gave Tyler a kit.

A key but not well known tutorial book was Beinecke's *Clean Energy, Common Sense – A Call to Action*. Frances Beinecke was then president of NRDC – that Natural Resources Defense Council, a group supported and endorsed by Utah's own Robert Redford. He wrote the book's Foreword. I read it in early 2010, shortly after it was published. Redford compared it to Thomas Paine's *Common Sense*:

'I offer nothing more than simple facts, plain arguments and common sense.'

The Ehrbar meeting included a panel discussion on greenhouse gases, global warming, and climate change. A number of the speakers addressed HJR 12 and 21, and the Governor's BRAC report. I was part of the panel. My concluding statement and take-home message was:

"The issue is NOT Science...the issue is BELIEF. If you choose to Believe in something very strongly and you choose to adopt a position very strongly – no amount of science will change your Belief. It takes a private revelation... to really change... We must understand that rationality is quite rare... We must identify those totally irrational legislators... and get rid of them."

That was when some George Bush staffer said something like:

'We create our own reality.'

Mark Mooney's prescient book, *The Republican War on Science*, appeared in 2005 – in little George's second term. Mooney later published *The Republican Brain* in 2012. It's epigraph was Stephen Colbert's comedic but serious 'Reality has a well known liberal bias.'

An early 2010 event was the Supreme Court's Citizens United decision, essentially allowing all political donations to be unregulated, uncontrolled. That fueled the massive increase in money into political ads, social media, misinformation, disinformation, increasing uncertainty, obfuscation, and chaos.

Our District 2 Congressional representative was Jim Matheson, a well known Democrat and son of former Governor Scott Matheson. Jim's margin of victory in the District 2 elections was getting very small. Matheson had become a blue-dog Democrat, tilting to the right to secure Republican voters to allow him to win. He became the head of the Blue Dog coalition. He had tilted so far that he'd been losing his Democrat base, including Barb and me.

## Tim DeChristopher

There was great excitement and activity associated with Tim DeChristopher's BLM protest action, arrest, and trial. Liberal, progressive Democrats became empowered to counter Matheson. Probably organized in part by DeChristopher's new group, Peaceful Uprising, a meeting was held in the SLC Library Tessman Auditorium to select a 'people's candidate' for the District 2 seat. Several candidates agreed to serve. After some discussion and short speeches, Claudia Wright, a history teacher at Cottonwood High School, who had taught Tonio, Aaron and perhaps Nina, became the people's candidate. She competed with Matheson at the local Democratic convention, garnering sufficient support to require a primary election. This was the first time that Matheson had any real competition at the convention. Although Matheson won the primary and went on to just barely win in the November election, his margin was very small. We were all pleased with Claudia's performance and with the message delivered by her and DeChristopher to the Utah community.

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Tim was declared guilty and sentenced In July, 2011. The severity of the sentencing led to major protest in downtown SLC, including stoppage of our public transport TRAX line near the Courthouse. Tim was hauled off to jail; appeals were unsuccessful. The documentary *Bidder 70* was released in 2012. He served some 18 months, and was paroled in April, 2013 with the help of a job at Ken Sanders Bookstore. Tim then went off to Harvard Divinity School.

Huntsman resigned from his position as ambassador to China, effective April 30, 2011, in order to return to the United States to explore a 2012 presidential bid. In August, 2011 he Tweeted:

“I believe in evolution and trust scientists on global warming. Call me crazy.”

The Republican party told him ‘We’re not interested.’ He then dropped out of the race. He said the evolution statement was precipitated by

“...a level of frustration with the nonsense that was taking place in the early debates.”

The Occupy movements in late 2011 were very inspiring. I was also stimulated by discussions with my son, Tonio – who is very concerned that he and his wife are raising three young daughters in a very problematic, dangerous, and uncertain world. The late Dr. Steven Schneider was another inspiration for me. Jim Hansen’s *Storms of My Grandchildren* and my own grandfatherly perspective also influenced me.

I wanted others to also get involved, particular youth, students, and the ‘young’. I wrote

*The Call: Towards Personal Independence and Responsibility* in early 2012. *The Call* is a pamphlet for teens and others to take control of their life and world. I began to cite it and to distribute it on line. Aaron designed a final version which I distributed in late 2012 and through 2013 and beyond.

## Beginning The Run

But, if I was ‘calling’ for others to Run, and as Bill Barron was running for Senate as an unaffiliated candidate, he talked me into – and of course inspired me to – Run for Congress.

In 2011, as a result of the year 2000 census data, Utah was allocated an additional Congressional district, ‘allowing’ Utah’s super-majority Republican legislature to gerrymander its now four congressional districts.

I had been considering running in either District 2, my ‘old’ district, or in District 4, my ‘new’ district. On December 15, 2011, Matheson announced that he would run for the newly created seat in the new 4th congressional district, meaning there would be an open-seat race for the 2nd district. The 2nd district race was not expected to be competitive for Democrats. So I chose to run in District 2.

Earlier I had talked with Jim Dabakis, a prominent Democrat and head of the Utah Democratic Party. He asked me to consider running as a Democrat:

‘How much can you raise?’ he asked. ‘That’s the key criterion.’

“\$5,000,” I answered “...of my own money.”

He now expressed disinterest.

I resolved to run as an Independent – unsponsored – unaffiliated.

My campaign was launched with the statement:

This campaign is targeted to adults –

individuals who can deal with facts, realism, and practical approaches to issues and problems. I will not be seeking donations and will run few, if any, ads.

I will be factual, honest, and transparent.

Thomas Paine said it best:

‘I offer nothing more than simple facts, plain arguments, and common sense.’

Our family spent the Christmas 2011 through New Year holidays in Folly Beach, SC. We discussed my interest in running for Congress. We brainstormed logos, maps, bumper stickers, and related materials for a campaign, as well as the logistics of securing sufficient signatures to create a place on the ballot as an unaffiliated candidate. We realized I had no chance to win – that the campaign would be an exercise in education and awareness for the Utah public. I’d utilize Don Quixote as a symbol.

In the new 4th district race, Matheson squeaked by the Republican Mia Love by only 768 votes. The so-called writing was on the wall for Matheson’s political future in Utah.

I ran for US Congress in 2012 in Utah. I lost – that was intentional. I placed 4th in a field of 5, receiving less than 1.2% of the vote. That was not intentional. I spent \$5,700 on the campaign – \$700 over budget. I ran as an independent,

unaffiliated, no contributions candidate. No party. No hidden agendas. The entire effort was later summarized in early 2013 as a little book for aspiring politicians titled *The Run – My One-Year Experiment in Democracy*. Parts of that little book are used in the text below.

## Ballot and Platform

My platform, *Toward a Sustainable Future*, was based on: getting money out of politics to help restore democracy; developing a truly sustainable, inclusive, forward-oriented economy with jobs for all; providing accessible health care for all; providing accessible education for all.

Utah is a very Republican, highly conservative state and functions as a partial theocracy due to its very high Mormon population. District 2 is one of four Utah Congressional Districts – all ‘designed’ (gerrymandered) to consist of about  $\frac{2}{3}$  registered Republicans and  $\frac{1}{3}$  registered Democrat voters. There are many other voters who claim to be ‘independents’, although many independents are often even more conservative and non-progressive than many Utah Republicans. Libertarian and Constitution parties generally have a good showing in Utah races.

I did not have any chance of winning. Many rational people thought I was crazy to run, saying my effort was a total waste of time. But my run was about beginning to challenge deeply entrenched, hard-wired assumptions and ideologies – using the legitimacy of being a candidate for Congress as a platform and foundation for public exposure and awareness.

My major goal was (and still is) to get money out of politics. I ran a no contributions campaign – spending \$5,000 of my (our) own money. I ran no ads and purchased no media, except for t-shirts, bumper stickers, and several magnetic signs for our 1996 Subaru Outback.

I was told by a national blogger I contacted, “no dollars means – no chance!”

My initial naïve optimism was based on getting supporters to actually work on the campaign.

My site said:

‘In lieu of money, I need You to donate time and action – contact neighbors, friends, colleagues. Let them know about my candidacy and our goals and approaches’.

Almost no one did.

The first step was to get on the ballot, which is not difficult in Utah. Salt Lake City’s former mayor Rocky Anderson:

“Utah is actually one of the more democratic states in giving voters a real choice by allowing third-party or independent candidates on the ballot without enormous obstacles.”

I went to the state Elections Office in the Lt. Governor’s office, learned that I have to get at least 300 verified signatures – on special petition forms – of registered voters and residents of District 2, submit them to the County Clerks for verification, and submit the verified signatures and a fee of \$435 to the Elections Office by 5 pm, March 15, 2012. That’s all it takes to get on the ballot in Utah as an unaffiliated candidate for the Nov. 6, 2012 election.

On March 9 I submitted 355 verified signatures (out of a total of 456 collected) and was then placed on the 2012 Utah Ballot in all Counties included in District 2. Several key volunteers assisted in getting the signatures in dog parks, coffee shops, book clubs, stores, malls, and on the street. It was not difficult. Dog parks are especially good and easy venues as the human users generally are somewhat bored and willing to engage!

Now there was no turning back – I was to be on the ballot. Shortly after the March 15 filing deadline, the list of candidates was made public. I learned that there would be 5 candidates for the District 2 seat: a Republican, to be decided at their state convention; a Democrat, to be decided at theirs; a Constitution Party candidate; another unaffiliated candidate, Charles Kimball; and me – an unaffiliated candidate. I did not know Charles Kimball at the time; we became friends and allies during the campaign.

Aaron and Jake Hanson worked with me to quickly develop and implement a campaign website – 2012andrade – as a Google site, now erased. Jake further developed a more polished site as [2andrade.org](http://2andrade.org) (no longer accessible). I also set up a Twitter account as @JoeAndrade2012, and slowly began to Tweet.

## District 2

Utah District 2 is enormous. It includes nearly  $\frac{3}{4}$  of the Nevada-Utah border, over half of the Utah-Arizona border and the great bulk of Western and Southwestern Utah. It includes part of Salt Lake City but very little of adjoining Salt Lake County. The carefully gerrymandered District boundaries were designed to assure that Salt Lake City's Democratic Party majority would be diluted by the highly Republican area of Washington County in Southwest Utah, where the state's second largest urban area is located (St. George, Utah). Careful boundary adjustment resulted in a roughly 2:1 advantage for registered Republicans. The 2:1 ratio also roughly holds for Mormons to non-Mormons. Mormons tend to be overwhelmingly conservative and Republican. Although the Mormon Church claims to be apolitical, most of its members take their cues and guidance from Church leaders, who are overwhelmingly Republican. Utah is indeed an informal theocracy.

But Utahns could elect Democrats, as exemplified by Governors Cal Rampton and Scott Matheson in the mid-60s to the mid-80s; Senator Frank Moss in the 60s; and Congressional reps Orton, Owens, and Jim Matheson. Ogden's Steve Olsen made a good showing in his 2006 run in Congressional District 1. After losing, he summarized his experience and philosophy in his little 2007 book: *Why You May be a Liberal (and why that's okay)*.

My young, naïve, optimistic, then 70-year-old mindset began to develop an approach and strategy which I hoped would lead to a reasonable showing. I would begin with targeting new potential voters and by focusing on the over 50% of Utahns who do not vote in major elections.

I would interact with high school seniors, college students, and with the University/College and science education communities in which I had worked for many years. My plan was to empower and involve them in a 'grass-roots', hopefully 'viral', campaign which would rapidly grow and develop.

Although generally familiar with the national parks, towns, and roads in the district, I bought and studied maps, became familiar with the various counties represented by District 2, and developed 'business' cards, signs, and logos which showed the District map and boundaries. As the new District 2 was different from the old district, most voters were unaware of the changes. And of those



who were aware, many were confused as to the actual boundaries and the areas included in the new district. My business cards, signs, and T-shirts all included a district map which greatly helped inform potential voters.

There are 33,000 people every year who can choose to become eligible voters – the state’s high school graduates. Their voting statistics have been terrible – only about 1/4 actually vote. Utah educators are, in general, extremely cautious about talking or working with their students about any issue or activity which can be considered even remotely ‘political’. So most graduating seniors are not politically engaged – and tend to stay that way after graduation.

Most Utahns do not encourage their kids to think for themselves (Utah is one of seven states which never ratified the 26th Amendment – providing the vote to those 18 years of age or over). Utah’s high school students are expected to participate in Mormon Church activities, prepare themselves to serve on a Church ‘mission’, and otherwise to behave as good Church members – meaning they become Republicans, like their parents and friends.

But they are also adolescents dealing with their hormone fluctuations and their concern with their own role and place in society and the world – and such concerns tend to not be well addressed by their parents, teachers, or their Mormon bishops. But they are addressed to some extent via social media and the Internet. To address those adolescent yearnings – needs I can still recall vividly from my own adolescence and young adult years – my little book *The Call* was made available as a free e-pamphlet via my sites, e-mail, and word-of-mouth in early 2012. I began to try to interest school groups, teachers, media, and others in *The Call*, with almost no results.

The 33,000 high school graduates mean that there are roughly 8,000 in each of the 4 districts. Total votes cast in the 2012 election were roughly 1 million – about 250,000 per Congressional District. Thus even if all high school graduates were successfully involved and voted, they would be only about 3% of the results. But, assuming that the entire 18 to 25 year old youth component could be so engaged, they could be as high as 20% of the total vote!

I tried to engage high school seniors via an op-ed piece in a major daily newspaper, via letters to most major high school papers, and letters or op-eds to regional papers (see *The Run* for details and examples). Access to the rest of the youth population was more difficult; we worked to contact them via college and

university papers and via regional papers, as well as by social media, especially Twitter, although we did run a few Facebook ads early in the campaign.

## Energy

One major reason I chose to run in District 2 is the enormous alternative energy potential in Western and Southwestern Utah. Utah was (and is) plagued by a Governor and a Legislature focused on fossil fuel-based energy development. Back in 2012 that even included shale and oil/tar sands. They do not consider and are actively disinterested in the enormous solar, wind, and geothermal resources of the State.

The Governor's Energy Summit in Feb. 2012 did include a set of sessions on alternative energy (organized in part by Sarah Wright of Utah Clean Energy). That session was an eye-opener for me with respect to planned projects and the alternative energy potential of southwestern Utah.

I learned of the Parker Knolls proposed hydro-storage project southeast of Richfield; the Magnum Energy compressed gas storage project in the salt caverns northeast of Delta, and the BLM's designation of Solar Energy Zones in Utah. This background reinforced my own thinking and provided the foundation for a platform emphasizing renewable energy development throughout the district.

My first official campaign request was from a group called the Six County Association of Governments (SCAOG). They invited all candidates for District 2 to a Meet the Candidates discussion on April 3 – during their conference in Richfield. I eagerly accepted – and proceeded to develop a platform and an appropriate 'speech', titled Creating the Future in District 2. I was completely inexperienced and naïve about political campaigning (my last elected office was high school student body president in 1958–59!). I had never served in a political campaign, so the other candidates' displays and materials at that early meeting were an eye-opener.

All the Republican candidates had tables with fancy brochures, us flags, banners, signs, and even structures with signs and messages. Several had already

spent my entire campaign budget! The materials were not substantive; the ‘platforms’ were minimal – basically anti-Federal government, anti-Obama, pro-Tea Party – the standard Utah right wing mantra. But they were colorful. We all spoke at the afternoon Meet the Candidates session.

Our session followed a legislative update session which featured State Representative Mike Noel, a major climate denier whom I had argued with in earlier legislative hearings. Noel’s remarks ‘introduced’ me and my candidacy. He said that my environment and climate concerns were ‘...destroying jobs for his 18 grandchildren!’ It was fortuitous that he was there and mentioned me – it allowed me to emphasize renewable energy resources and sustainable jobs for his grandkids.

I was able to meet with several people in Richfield, including Dick Cumisky, President of Sevier Citizens for Clean Air and Water, and Michael Orton, a local progressive. I learned that a woman from Torrey, Utah, Ty Markham, was running against Noel for the state House seat representing southern Utah. Noel was used to running unopposed.

On the way ‘back’ from the Richfield event, I drove South to Junction, then East through spectacular Kingston Canyon to Otter Creek Reservoir, and then North on State Road 62 – to see the site of the proposed Parker Knolls 1000 Megawatt hydroelectric energy storage project. Had the project proceeded to implementation, it would have been the largest energy storage facility in Utah and perhaps the Intermountain West. And almost no one in Utah knew about it!

Rolling north on State 62 to connect to 24 and on back home, I drove through Koosharem. I knew the name, as that was the original home of our lovely Highland Drive neighbors, Mazel and Melba Nielsen.

From a political strategy perspective, I should have focused nearly all of my time and effort on relatively progressive Salt Lake City – where many of the district’s voters resided. But the people who really ‘needed’ my perspectives and approaches – and whose assumptions and beliefs most needed to be challenged – were those outside of Salt Lake City. The great majority of these people were and are very conservative, right wing, Mormons with a 19th Century mind-set with respect to energy and economics. I chose to focus on them, as my run was more about perspective and culture change than about winning.

One of my campaign’s ‘messages’ was to help make the residents of District 2 aware of and interested in their renewable energy possibilities. My goal

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was to challenge assumptions and to encourage creative perspectives and thinking. There were a few with such perspectives: a former Beaver County Commissioner told me:

‘Renewable energy is a Godsend for Southern Utah.’

My goal was to help deliver that perspective throughout the district. I should have quoted him on signs and posters placed throughout southwest Utah!

# Campaign

I told myself that I didn’t need to really begin campaigning until Summer, 2012 – after the Democrat and Republican candidates were selected. I could then use the Spring months to meet my constituents, become informed about the communities and lands in the district, and to generally learn much more about District 2. That was well and good, but I should have had appropriate signs and other name recognition materials. Dyman and Paola Neyme purchased their own bumper stickers and gave them to me!

I developed a campaign e-mail list of supporters, sympathizers, and ‘tolerators’. The latter are people not necessarily supportive or sympathetic but willing to listen and read. The list expanded daily. Anyone I had any discussions with was on the list. I sent campaign updates to the entire list at least monthly. I asked the Campaign Update e-mail recipients to forward the material on to their contacts, with the note and request to become involved. But we never came close to going ‘viral’.

I understood that T-shirts would be very effective and experimented with iron-on, home-made versions. A friend informed me that T-shirts are really not expensive. I committed to an initial order with a distinctive design that we used for the entire campaign. Our second order and revised design was especially effective, but did not materialize until August, 2012. Only about 100 shirts were purchased. The May through October campaign season in Utah is ideal for T-shirts. I should have ordered perhaps 1,000 or more, and distributed them widely to volunteers, supporters, and sympathizers. They serve as walking – essentially free – billboards.

I finally did obtain bumper stickers which were quite effective and relatively inexpensive, but not until nearly July. We obtained some 400 and used perhaps 250 or so. I should have obtained and distributed them earlier. Although some people are hesitant to ‘mar’ their cars with bumper stickers, they can be used on laptop cases, luggage, backpacks, windows, etc.

We made our own lawn signs. A friend had run for Governor (against Huntsman) many years earlier. He gave me several hundred of his obsolete signs. Several large ‘teacher’-size magic markers and a little practice produced very legible and effective signs. I invested in 100 metal lawn sign mounts and began to place signs. Unfortunately, we didn’t really begin until perhaps September. I had assumed that signs placed earlier would just annoy people and wouldn’t be very effective. Big mistake! We had sign-making demonstrations at several farmer’s markets and in my home. We placed signs in some strategic locations – such as the entrance to Mill Creek Canyon, a major local recreational site (thanks, Andy!); and on the road to Emigration Canyon (thanks Lee and Sally!). The 50 or so signs we placed were very effective – but they were too few and too late. Generally people loved the fact that our signs were hand-made from old, recycled signs – enforcing our ‘money out of politics’ position.

We submitted Letters and Opinion pieces to the various local papers, with very modest success. Most such pieces were written by me. I contacted and worked with the major rural papers throughout District 2, as well as the five major daily papers:

*Spectrum* – St. George, Utah • *Salt Lake Tribune* • *Deseret News* • *Ogden Standard-Examiner* • *Provo Daily Herald*

Most papers have a publication limit – no more than one submitted piece per month per person. Some, especially some of the rural papers, see candidates as a way to generate advertising revenues and thus choose to not publish their letters. I did not purchase or run any ads. Several papers did indeed agree to interviews and ran brief stories.

A local Spanish language paper, *OKEspanol*, was contacted by our volunteer Hispanic coordinator, Fanny Guadeloupe Blauer, resulting in an early interview. This paper and their key reporter stayed interested in our campaign and covered later events.

Several papers and organizations offered free Voter’s Guide profiles – some via a small bio and others via response to specific questions. A local

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neighborhood paper, *The West View*, published the best Voter's Guide of 2012 in their free paper. Various organizations also produced Voter's Guides and input to specific questions. The best of these was the League of Women Voters (LWV).

Our local PBS affiliate, KUED TV, Channel 7, through the VoteUtah2012 project, enabled every candidate in major races to participate in a 2 1/2 minute 'free speech' studio 'shoot' for airing on Channel 7. This was the only free TV coverage available to all candidates. My video aired on Sept. 24, 2012.

Radio exposure was also very limited, especially for unaffiliated and third party candidates. I was fortunate that a local public radio station, KCPW FM, became interested in my 'Don Quixote'-like campaign and my initial slogan, 'I put Utah Third' – building on incumbent Congressman Jim Matheson's mantra: 'Matheson puts Utah FIRST'. Reporter Jeff Robinson did an early interview on his *Politics Up Close* show on March 23, shortly after the candidate filing deadline.

The inability of third party and unaffiliated candidates to get media access was addressed in a forum on Oct. 15 at the Salt Lake Public Library Auditorium. This forum, catalyzed by me and Charles Kimball, was moderated and co-organized by Jeff Robinson, who had been with KCPW-FM. Titled What do Independent and Third Party Candidates have to offer Utah?, the Forum had about 50 people in attendance, was announced and broadcast on KCPW-FM, and was noted in later print media stories.

Reporter Andrea Smardon with the local NPR affiliate, KUED FM, became interested in the challenges of independent candidates and did a feature story on Oct. 24. KUSB Cedar City (590 AM) did an audio interview on Oct. 26, following up on the District 2 debate the previous day in Cedar City (see below).

Radio/TV exposure was very limited. I should have reached out to talk radio and other broadcast sources. Some inquiries were sent, with no response – but I was just not aggressive enough in getting on the air.

Although I chose to not do any mass mailings, we did do some very targeted mailings using semi-personal letters.

## Debates and Protests

Candidates for major political office are expected to debate each other. We expect forums where the candidates respond to questions and otherwise make themselves and their positions known to those in attendance. Some radio and TV stations did indeed organize and conduct District 2 debates, but only for the ‘major’ candidates: the Republican and Democrat Party nominees. In such cases the third party and unaffiliated candidates were not even mentioned. That was also the case for most of the press stories resulting from the debates.

The two independent candidates, Charles Kimball and I, argued long and hard to be included, with only one success – the Southern Utah University (SUU) Leavitt Center for Politics District 2 debate of Oct. 24.

The Republican candidate, Chris Stewart, actively argued against including any but the two major candidates. Many people feel that third party and unaffiliated candidates function as ‘spoilers’. They did not appreciate the new and different perspectives such candidates can bring to the discussion. Interestingly, many in the audience at the SUU debate noted after the event that the unaffiliated candidates were the only ones contributing anything new to the discussion.

I am now convinced that for now (until the nation’s campaign and campaign finance processes are drastically changed) the most effective way to ‘earn’ media is to make it – via protests and related events. I learned this too late in the campaign to be very effective.

In mid-October I learned that KUTV Channel 2 would be hosting a debate for District 2 candidates Jay Seegmiller, the Democrat, and Chris Stewart, the Republican. I contacted that station and inquired as to why only those two, as there were five candidates on the ballot. The program coordinator tried to ‘explain’ that only candidates polling at 5% or more are generally included. When gently ‘pushed’ he admitted he had no polling data – but would not consider including any other candidates. I informed Charles Kimball, who then also made inquiries, but to no avail. So I decided to ‘protest’, issued a Media Alert to the press, and recruited some volunteers to participate. Several supporters and I showed up at the entrance foyer of the KUTV studio in downtown Salt Lake City, with large hand-made signs saying: Boycott KUTV for Political Discrimination. Our timing was good. The two ‘major’ candidates entered the foyer when we

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were there and were escorted into the studio; we followed them in but we were denied entry. I had some semi-heated discussions with the building's security lady – who responded to our most rational questions with the classic rational statement ‘...it’s a private building and you are now trespassing. Get out.’

I insisted on calling the program coordinator and the reporter doing the interview, Rod Decker, whom I knew from previous non-political interviews and stories. This was while the security lady was calling the local police. I did reach Dan Kaufman, program coordinator, let him know what was happening, and ‘insisted’ that he let Rod Decker know. Fortunately, he did – and then promised me that Decker would come out and interview us on the sidewalk (outside the building) after the debate filming. We left the building before the police arrived.

The best photos of the event were made available online by *OKEspanol* (who had a photographer present for our protest). *The Salt Lake Tribune's* coverage of the ‘debate’ did briefly mention the protest. Two policemen did indeed appear and proceeded to inform us that we had been trespassing. We gently and rationally argued. I gave them my business cards, requesting that they vote in the November election! Rod Decker and a cameraman then appeared, and we had a good discussion, which briefly aired on KUTV.

The protest coverage – both by KUTV and the print media – helped spark the KUER FM coverage and program on third party and unaffiliated candidates, noted above. Our KUTV protest coverage was probably far more effective than the coverage of the actual Seegmiller-Stewart debate. We captured our own video of nearly the entire protest event. Thanks, Jake.

Had we done such protests much earlier in the campaign – and kept them up – I am sure we would have done much better in the election results. The fact that we did protest – and got serious coverage and attention – made our little campaign far more interesting and credible.

I then heard that the Salt Lake Rotary Club was having a Seegmiller-Stewart event at their luncheon meeting on Oct. 30. After some inquiries, I learned that they only include those polling ‘...at about 15% or better’ – but again no data. I have some friends in that Rotary Club and informed them I would be protesting their event and policy, and had issued a Media Alert.

Their event was at the downtown Marriott Hotel, in one of the ballrooms. I found a table and set up signs and materials, very close to their member



registration/sign in table. It was a friendly protest. There was media to talk with. I said that:

“...although I have great respect for Rotary, they do their members and the political process a great disservice by not being inclusive.”

No police this time!

## On the Road – 7 Trips – 4,360 miles

I put cool, magnetic signs on my red 1996 Subaru Imprezza Outback and set out to further experience Utah's District 2. I combined 'campaigning' at several locations with the hands on energy workshops and demonstrations I did as a volunteer for The Leonardo – at various natural resource, green, or renewable energy festivals. I wore a unique, black TheLeonardo T-shirt at such events. Later in the campaign I was a walking billboard with my Andrade... Congress... For a Sustainable Future T-shirt.

*Campaign Trip 1* (320 miles, one night) was to the SCAOG candidates' forum, April 3–5 in Richfield – and a friendly introduction by and response to Mike Noel. I then drove State Road 62 to the proposed Parker Knolls 1000 Megawatt hydroelectric energy storage project site.

*Campaign Trip 2*, April 20–26 (700 miles, 6 nights), was to Springdale, the gateway community to Zion National Park. I set up a table and energy demonstrations for TheLeonardo at the Springdale Earth Day festival on April 21. This was not an official campaign event but served to make festival visitors aware of energy principles, renewable energy, and the energy potential of south-west Utah. Springdale is one of the most green and progressive communities in Utah, so it was a very receptive audience. I met with several local residents to obtain advice and perspectives related to nearby Dixie College and St. George.

After some hiking in Zion National Park, I had a set of meetings on April 23 in St. George and Washington County (population 75,000 and 142,000, respectively). David Clark, the leading contender for the Republican nomination

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for District 2, worked, lived, and represented the St. George area in the State Legislature. I met with one of the very few Occupy St. George participants, a student at Dixie College, and with a local feature reporter – obtaining perspective on local issues, politics, and on Dixie College. I also met with the city of St. George Water Services and Energy Services Directors. I had a special interest in their community solar activities, called the SunSmart program. Water was also of key interest, in lieu of the politics of the proposed Lake Powell Pipeline and water use/conservation discussions in the Southwest. Part of my agenda was to raise the question of impending severe drought stemming from climate change and growth. Today, in 2022, Lake Powell is going dry – the pipeline issue has literally evaporated.

My goal was to listen, ask questions, gently challenge assumptions, and introduce words like sustainability and stewardship to the discussions. While in St. George I became familiar with the organization and layout of Dixie College, to be the focus of a future trip.

In Cedar City I visited Southern Utah University (SUU). Having heard of an upcoming Engineering Technology Fair and awards ceremony at SUU, I had earlier talked my way onto the program, as an ‘invited’ speaker. This was easy as I had been Dean of Engineering at the University of Utah and served as a credible and even ‘prestigious’ speaker. Clearly not a campaign event, my very brief talk was titled *Creating the Future: Creatively, Realistically, Critically, Responsibly, and Efficiently*. It addressed my concerns with resources, climate, and a sustainable economy. While at SUU I met with several faculty interested in environment and climate issues and in rural economic development – as well as several other people in the Cedar City community.

On to Milford and a very unique event: the 4th Annual Milford Renewable Energy Fair, an event by SUTREC – the Southwest Utah Renewable Energy Center, a project of SUU and Milford High School. I manned an energy demonstration table for *The Leonardo*. The audience was very responsive as this was/is one of the few regions in Utah with a serious commitment to renewable energy. Milford is famous in Utah for the state’s first major wind energy project, the result of an innovative high school teacher and his students who happened to reside in a very windy part of the state. It’s a great story!

At all these events, meetings, and travels I tried to interact with everyone I met – motel clerks, gas station attendants, restaurant staff, etc. to inform them of the race, my candidacy, the district map.

*Campaign Trip 3* (750 miles, 5 nights), May 11–17, began with a The Leonardo energy demonstration gig at the Richfield Resource Festival, a community event focusing on natural resources, agencies, education, and public awareness.

I then routed on to Kanab to attend their Amazing Earthfest event: Invocation to Sustainability. Founded and organized by Rich Csenge, Amazing Earthfest provided education and experiences to Southern Utah participants and attendees related to sustainability, renewable energy, land preservation, and resource issues. Amazing Earthfest continues to inform and educate the peoples of southern Utah.

As the Eastern Gateway to Zion National Park, and due to its great climate and lovely red rock canyons and landscape, Kanab had attracted visitors and new residents, many with progressive leanings. It was then on – via the Arizona Strip – to St. George.

May 14 was focused on St. George, visiting the Bureau of Land Management (BLM) regional manager and a Washington County Commissioner. We had a good discussion about the importance of Federal funds to rural counties, including Payments in Lieu of Taxes (PILT) – about \$36M/year to Utah – and the Rural Schools Fund. During our discussions he looked wistfully at the map on my business card, noting all the energy resources in Eastern Utah and the lack of such in southwest Utah. I tried to get him to appreciate that southwest Utah has enormous renewable resources, and that a little awareness, attention, and planning would make for great economic development. It was a start...

I met with Dixie College faculty and volunteers. I tried to recruit Dixie students as interns/volunteers, but it was too late in the term – that would have to wait until the fall term – and then that turned out to be unsuccessful. I had the same intern non-result at SUU, Westminster College, and Snow College.

Then it was back to Kanab to officiate at a Future of Kanab essay contest for high school seniors, part of the local Amazing Earthfest activities. Although not a campaign event, I was able to meet several City and County elected officials and others in the Kanab community. Three of the four essay contest ‘winners’ and panel participants emphasized the need for Kanab to retain its

beauty and environmental attractiveness. Kanab's small, relatively progressive, environmentally aware community is embedded in a larger, very conservative, and very traditional group. The more established, conservative element tends to populate City Council and County Commissioner chambers. It was very important for a few of them to hear that their grandkids are indeed concerned about environmental issues. I also did several in class energy workshops at Kanab High School. Discussions with the Kanab region BLM Director and with the Manager of the Grand Staircase-Escalante National Monument (GSENM) were very helpful.

On the way home I visited the Superintendent of Bryce Canyon National Park, learning more about the enormous impact the Park has on local communities. Panguitch, a gateway town to Bryce Canyon, is a small, rural community highly impacted by coal trucks from a new Alton coal strip mine southeast of Panguitch. The trucks roll North and West to railheads at Cedar City or to the Intermountain Power Project (IPP) coal facility outside of Delta, Utah. A proposed major expansion of the Alton mine would inundate Panguitch and connecting roads with coal trucks. The few mining and driving jobs are a big deal for small communities like Alton and Panguitch, which are almost totally unaware of the potential for renewable energy activities in their areas.

The Trip 3 visits and discussions further reinforced my commitment to a renewable energy – based economy for Utah's District 2.

*Campaign Trip 4* (475 miles, 3 nights), June 14–17, began in Delta with a visit to the Intermountain Power Plant, to the site of the new Topaz Museum, and a discussion with a major dairy farmer, Joe Andrade (no relative, and conservative). Joe was very busy, so 'met' me on and in his large grain thresher. We talked above the noise of a rolling machine threshing grain.

I also visited the Delta Library and received a quiet 'endorsement' by their favorite son, Mark Twain – a signature sculpture. I made some contact with the local *Millard County Progress* paper, but they didn't respond to my later submissions.

My discussion with Millard County's Economic Development Director was very informative and helped catalyze my platform regarding economic development and rural/urban growth. I developed the thesis that the inversion-prone Salt Lake and Utah counties should direct their proposed growth to Delta, Richfield, and other more rural communities. The growth along Utah's

urban Wasatch Front has resulted in very severe air pollution, massive highway building programs, and a range of serious land use issues. Plans for oil refinery expansion (just north of Salt Lake City) and a huge expansion in the Kennecott mining operations – all in the small, inversion-prone Salt Lake Valley – mean that air quality, health, and well being will all continue to deteriorate.

‘Your problem is our solution!’ said the Millard County Economic Development Director.

Why continue to grow, pollute, and congest Salt Lake City and County when other regions of the state could easily accommodate such growth? Good question.

The position of Mayor of Salt Lake County was also on the 2012 ballot. The two major mayoral candidates were each endorsing enormous population and business growth projections AND supporting cleaner air. Their traditional assumptions and mind-set were and are inconsistent with the need for a sustainable economy and stable population. In their presence I began to emphasize the sustainable nature of my platform and to note the inconsistency of their platforms.

After the Delta discussions I headed West to the Snake Valley Water Festival in Baker, Nevada (practically on the Nevada-Utah border) and to Great Basin National Park (GBNP). Although in Nevada, GBNP is a key Federal Land neighbor of District 2, with Delta serving as a gateway city to the Park.

Snake Valley is the site of an ancient underground aquifer which the City of Las Vegas wants to exploit as a water source for its unsustainable growth objectives. This is a key component of Utah’s serious water issues and water resource debates. I learned of the Great Basin Water Network (GBWN), becoming informed of issues and actions via their alerts and announcements.

Utah’s First Nations are also very concerned with water resources, land use issues, and appropriate renewable energy development. The Snake Valley water issue is paramount to the Goshute peoples who reside in the Nevada-Utah border region.

On all these trips and outings, whenever and wherever reasonable, I was a walking billboard with my prominent campaign T-shirt, as well as displaying auto signs and bumper stickers. I pinned my business cards to rural post office and other bulletin boards whenever I could.

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*Campaign Trip 5* (July 6–13, 750 miles, 7 nights) began in Ephraim at Snow College, where I tried to identify faculty and student groups for later contact, then on to Manti and the office of the Sanpete Messenger for an unscheduled interview, which resulted in an interesting story and photo. Torrey was next, to participate in the annual Apple Days parade, where I marched with my large hand-made campaign sign and had discussions with others in the parade – nearly all conservative and one vehemently anti-Obama (his float of granddaughter princesses won first prize!).

Torrey and its ‘suburb’, Teasdale, are somewhat like Springdale: fairly progressive gateways to a major national park (Capitol Reef), and home to many new residents, as well as many old-timers. There is a strong contingent of *uu* faculty and staff with property in and connections to the area. Along the parade route I saw and recognized many people from Salt Lake City and the *uu*!

After some hiking in Capitol Reef National Park, I met with other locals, including Ty Markham, running in Utah State House District 73 against Mike Noel. District 73 includes the State’s most rural counties: Wayne, Garfield, Paiute, Kane, San Juan, and Beaver. All but San Juan are in Congressional District 2. We compared notes, people, strategies, etc. Utah’s Federal Lands aspirations are most vocal in these highly rural counties. The land is largely Federally owned and managed – up to 94% in Wayne and Garfield counties. The paucity of private land and tax base provides serious challenges for these regions, although the counties do receive some Federal funds to partially compensate for such hardship.

I met the Capitol Reef National Park superintendent. We discussed visitation numbers, regional economic impact, the history of School Trust Lands, and community agreements and partnerships. The local paper, the *Wayne County Insider*, ran a story on my campaign and had a Meet the Candidate event in nearby Bicknell. There were four of us there!

Then it was on to Boulder and Escalante, along incredible Highway 12, and then via Tropic, Hatch, Mt. Carmel, and Zion Park to Springdale. I entered Zion Park from the East via Highway 9 through the unique Zion tunnel – the most spectacular way into Zion NP and Springdale! All the time, along the way, talking with people at visitor’s centers, coffee shops, diners, and gas stations.

I met with the Zion Park Superintendent and his assistant on July 10, learning about the very high visitor numbers of the park (over 3 million per year!),

the history and success of the Springdale/Zion shuttle system, and regional economic impacts. We also discussed transportation and access issues, Federal lands, and related topics. Then I went on to and through Washington City, Ivins, and Kayenta – to become more familiar with parts of Washington County. The City of St. George Conservation Manager was very helpful, as were discussions at Dixie College related to building and energy efficiency. The local paper, *The Spectrum*, did an interview, but I don't think it ever appeared. They did print some of my later letters, however.

While in Kayenta I met with the mayor of Ivins. We had a good discussion on renewable energy and efficiency. I also talked with several Kayenta residents. Then it was back North to Richfield but via The Grind Coffee Shop in Cedar City and other stops along the way. I attended the Richfield meeting of the Utah Alliance for Economic Development – to learn about Central Utah initiatives and to network with key officials and educators. I arranged an interview and a photo with the local *Richfield Reaper*, which, as far as I know, never ran. Then it was on home.

July was light on campaigning. Barb and I did get to Manzanita for the annual family gathering. There was some campaign activity, thanks to Paul Manda. Paul does video media for a Portland area school district. We did a 2Andrade Issues video for my campaign web site. I drafted and rehearsed a 10 minute or so platform talk. Then Paul and I did a single take production, on the lawn of Susan's Cottage, off Idaho Street. Thank you, Paul.

Andrea and Tonio ran the Manzanita Beach race and placed! Lots of beach, hike, and family time. Then back to Utah's District 2.

*Campaign trip 6* (505 miles, August 8–11, 3 nights) focused on the annual Rural Economic Conference in Cedar City. The two day meeting provided good background and perspectives related to rural economies and their development and potential. Held on the Southern Utah University (SUU) campus, it is generally well attended, includes displays, and this year a radio feed via Utah Public Radio. While at SUU I met with the people at the Leavitt Center for Politics, encouraging them to organize a District 2 candidate debate at SUU. We considered an Oct. 3 date for the debate. I also met with local residents regarding Cedar City perspectives and with a local BLM Manager.

*Campaign Trip 7* was directed to Tooele, about Aug. 17–22. On the way I routed through Magna, which is in District 2. I love libraries, so I was especially

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pleased to see and experience the new Magna Library. Then to Tooele Army Depot (TAD) to participate in a media event launching their solar electrical energy project. I learned of this project via a newspaper story, contacted TAD, and got an invitation to attend. This event further buttressed my arguments on the renewable energy economic development potential for District 2. I continued this approach with discussions at a Tooele Chamber of Commerce meeting on Aug. 22 – an update on the status and future of the three major Federal Department of Defense installations in the Tooele area.

Tooele County is also home to a major low-level radioactive waste storage facility, at Clive, off Interstate 80, operated by Energy Solutions, Inc. Much earlier I had suggested to Energy Solutions' management that they use parts of their one square mile facility to install solar panels and thus to truly be an Energy Solutions company. They did not seem interested.

Tooele County is very unique and interesting. It is huge and had several very large Federal facilities: Tooele Army Depot, Dugway Proving Grounds, Deseret Test Center, and Air Force bombing ranges, as well as the Deseret Chemical Depot, which was being decommissioned.

With the us Department of Defense now playing a leading national role in the development of renewable energy, some Utah state leadership and vision could facilitate a huge renewable energy economy for Utah – but such leadership and vision is non-existent. While in the area I visited Grantsville and saw their new library, under construction.

*Campaign Trip 8* was to St. George for a Faculty Forum lecture at Dixie College on Oct. 4, titled Responsible Citizenship – From Assumptions to Ideology – and on to Reality. Not a specific 'campaign' trip; my hope and plan was to do similar lectures at all higher education institutions in the District.

It takes time and persistence to organize such events, as most academics don't like someone from the 'outside' suggesting campus events – and are especially suspicious of active political candidates. Dixie College did respond and scheduled a Faculty Forum for Oct. 4, thanks to a young, very interesting history professor, Joel A Lewis, originally from the Chicago area. We had met and talked during my earlier visit to Dixie State. He was an expert on USA industrial interactions with Hitler's Germany before WWII. Fascinating. I asked and he kindly sent me the notes from his 20th Century European History course on



the subject. Most of that history was unknown to me – and unknown to most Americans.

My lecture discussion was video recorded, but in person attendance was sparse. The event was an opportunity for me to develop the argument and perspective that we are using 18th Century economic assumptions in a highly constrained 21st Century world. I thought such an historical perspective might help break through the hard-wired assumptions in which most people operate. I was to continue that argument and activity well into 2013 – and long after the Nov. 6, 2012 election. The talk was recorded but is no longer available at *dixie.edu*. I presented a revised version in 2014 to Hans Ehbar's Greenhouse Economics course at UU in early 2014 as Assumptions, Ideologies, Realities – Action from 1776 to Today (it's at [joeandrade.org](http://joeandrade.org)).

Lewis was forced to resign, several years after our discussions, in part for challenging his students with innovative assignments, according to a 2016 story by Dallas Hyland, whom I talked with in 2012 and who first introduced me to Lewis.

*Campaign Trip 9*, the last before the election, was for the Oct. 23 District 2 candidates' debate at SUU's Leavitt Center for Politics. The debate almost did not happen. I had initiated the interest during earlier visits to SUU and its Leavitt Center. When the new Leavitt Center Director started to organize the debate, the Republican candidate, Chris Stewart, wanted only the two major candidates involved – no third party or unaffiliated candidates. This was standard operating procedure for most Utah debates. Fortunately Charles Kimball, the other unaffiliated candidate in the race, pushed back very hard; I enthusiastically endorsed and supported his efforts, encouraging SUU and its Leavitt Center Director to push back against Stewart. Fortunately, he did, and the debate – all five ballot candidates – came together. It was broadcast live and online via Utah Public Radio. SUU organized a very substantive debate, with good questions and student questioners, and fairly good attendance. This was the only debate among all five District 2 candidates. The Mandas had flown into St. George, via Las Vegas, to attend the event and tour a bit of Southern Utah with us. Thanks to brother-in-law Paul, we did capture video of the entire debate.

Barbara and I, with Paul and Antonia, then headed East to experience Highway 14 and then Highway 12 to Escalante. Although there was little

publicity or impact from the debate, Utah Public Radio did followup with an audio interview via telephone from the GSENM visitor center in Escalante.

We installed a few Andrade Congress campaign signs and talked with a few people along the way, particularly in Escalante, Boulder, and Torrey – of course sporting our four campaign T-shirts wherever we went! We hiked in and rolled through Capitol Reef Natural Park, and then left District 2 just north of Hanksville.

## Urban Exposures

When I wasn't 'On the Road' I was in the Salt Lake City area participating in farmer's markets, meet the candidates events, street fairs, and related events – meeting people and generally campaigning. A former student, Moses Yang, having heard about my run and campaign, flew out from Oklahoma to help. We spent several days together, sporting T-shirts and talking with people, at farmers' markets, the Utah Beer Festival, and other venues. Thanks, Moses! Other supporters also wore shirts in public – in Canyonlands, at uu early fall football games, in downtown SLC. It was a well designed and informative shirt!

Salt Lake City has a large number of Community and Neighborhood Councils which meet regularly. Salt Lake County has a network of Senior Centers, each of which has a Meet the Candidates event. All candidates who are ballot qualified were automatically informed and invited to the senior center Meet the Candidate events in 2012.

I participated in nearly all of those which were within the District 2 boundaries. Other groups schedule similar events, but do not necessarily invite all candidates. It is important early in the campaign schedule to search "Utah Meet the Candidates". This is especially important for unaffiliated and third party candidates who tend not to be on the 'radar screens' of most organizations, agencies, or groups.

Represent Me Utah! – a local group advocating democracy – organized a Meet the Candidates outdoor event in Sugarhouse Park on Sept. 29. As I expected Chris Stewart to be there, I wanted to be more pointed and direct

regarding my alternative energy focus and his atrocious drill-anywhere-and-burn-everything Romney-based energy ‘plan’. So I wore a gas mask to illustrate the air quality problems associated with his plans – and sported a No Bullshit sign to deal with his inaccurate mutterings (it turned out he did not speak and left before I spoke). But my talk and approach were recorded and well received.

The Tooele Chamber of Commerce organized a large Meet the Candidates event at the local firefighters museum on October 10. All five District 2 candidates were present and spoke, although it was not a debate, nor were questions taken. I learned of a local Presbyterian Church’s Meet the Candidates event and talked my way onto the schedule on Oct. 21.

Although farmer’s markets generally discourage politician booths and tables, they were very receptive to people wearing political message T-shirts. The markets were held weekly during the summer and fall seasons. The farmers’ market crowd tends to be progressive, interested and involved in home and organic gardening, and very receptive to a sustainable economy perspective. Most were sick of the money emphasis of the major political parties and very supportive of an unaffiliated, independent, and no contribution campaign. Art, music, and related festivals are also very receptive.

I met Ray Wheeler at the People’s Market on 900 West. We became good friends; he is featured as the excitable Jay in *State Change* (next Chapter).

The key is to ‘work the crowd’ one person at a time – and especially the people running booths or tables at Farmers Markets. You get to know them after several weeks of strolling the market. I commented on their products and displays. I found one who displayed quotations, so we exchanged quotes. One of my business cards had five very significant quotes on it:

‘We can’t solve today’s problems with the mentality that created them.’ – Albert Einstein (paraphrased).

“If you can’t solve the problem, expand it.” – Dwight Eisenhower.

“The difficulty lies, not in the new ideas, but in escaping from the old ones.” – John Maynard Keynes.

“It is difficult to get a man to understand something when his salary depends upon his not understanding it.” – Upton Sinclair.

“An educated citizenry is the only safe repository for democratic values.” – Thomas Jefferson.

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I found one of the booths using my quotes during the market season!

We ‘did’ as many of these events as we could. My most enthusiastic and effective volunteer was Fanny Guadeloupe Blauer who, with her two wonderful children, Danny and Juliette, then ages 7 and 9, and her husband David, participated in many events. Fanny also took the lead in getting access to Hispanic media and events.

Shannon Kennelly was a wonderful University of Utah intern. She participated in many of the events, bringing some of her friends and classmates. Volunteers can very effectively work such events – wearing T-shirts and carrying small signs, business cards, and distributable flyers.

Some events also have Voter Registration booths, often via the local League of Women Voters chapter. Many also have environmental or sustainable non-profits represented, including local environmental education and related groups. The people visiting such tables are generally very receptive to learning about a candidate who shares their views and perspectives. I did not seek out events in Northern Salt Lake County or South Davis County, two high population density areas in District 2. This likely contributed to my low vote result.

## Nov. 6, 2012 – Election Day

That morning I was at the corner of Sunnyside Ave and Wasatch Blvd, near UU Research Park, doing my last honk and wave. One of the many cars speeding by that busy intersection apparently went around via Research Park and parked nearby on Sunnyside Ave. This woman walks up to me and said something like:

“Can you use some help?”

“You bet,” I said.

It was Cathy Kim, wife of Alex Kim, Sung Wan’s son and Tonio’s good friend. We waved and tried to induce honks for an hour or so, until the commuter traffic started to wane. Thank you, Cathy!

That evening we had a small party celebrating the end of the campaign. I indeed lost, as expected and widely predicted. Celebrants included Hladys, Hibbs, Paola and Dylan Neyme (who had printed my first bumper stickers),

Joon Bae – You Han Bae’s wife, In Suk Han, Ray Wheeler, and Carol Drown. The next day I removed the cool magnetic signs from the Subaru – and Barb and I went shopping for a new Prius. The one year experiment was finally over...

## Academic Apathy

The major disappointment of the campaign was not the ideology and ignorance of much of the ultra-conservative population – it was the apathy, disinterest, and lack of involvement of the education and academic communities.

I was then a ‘practicing’ academic – with 44 years of teaching, research, and administration in the state’s major University. A former Dean (of Engineering), Department Chairman (Bioengineering, Pharmaceutical Sciences), and a faculty member in four different departments during my career, I had many colleagues, friends, awards, and was, I think, held in generally high regard.

The University of Utah thinks of itself as a highly creative, collaborative, interdisciplinary institution – as do most major universities. But, like the others, it is also insular, conservative, and largely isolated from the society which funds it and which it is expected to serve.

I represented my campaign as ‘apolitical’ – no party and no donations, so clearly not ‘political’.

If one of my respected academic colleagues was running for Congress, I would likely have been very pleased – and would have endorsed, supported, and otherwise worked to assist the campaign – particularly an apolitical one. A few did work for my campaign – you know who you are. Many others said things like:

Thank you for running;

We need candidates like you;

Good luck – let me know what I can do (I did, they didn’t);

Wish I could help, but... (midterms, grants, travel, etc., etc.);

I’d like to help but I must remain neutral, non-political.

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Although I appreciate and thank those who said ‘I voted for you’ – I was very disappointed that most of those voters did nothing else. Most feel that the very act of voting makes them an exemplary citizen!

Most academics inherently distrust ‘politicians’ – even the very few derived from academia itself.

Most academics are very critical of fellow academics, especially of those outside their own disciplines. They think...

How can an engineer run for Congress? What could you know about politics? You have no political experience or qualifications.

I noted earlier the interactions and discussions with the Leavitt Center for Politics at Southern Utah University. They did indeed host a debate of all five District 2 candidates. Dixie College (now University) did host my Assumptions lecture (non-political), as noted earlier. Repeated inquiries to Westminster College and Snow College for such a lecture were ineffective.

And yet academics are among the most vocally critical of government, politics, and politicians. They generally advocate reform, change, improvement – so long as they don’t have to get their own hands or brains involved.

These attitudes are reflected in the academic organizations and societies, including the AAAS (American Association for the Advancement of Science), the ACS (American Chemical Society), and others. They have their programs of media awareness, public and societal ‘outreach’, science ‘communication’, etc. But they can’t become ‘involved’:

Because, they say, they are non-profit and thus must be non-‘political’.

Because they must be ‘objective’. Because, because...

But they do advocate for increased funding; they encourage political action against budget cuts for science. They can advocate for general self-interest, but they think they should not advocate for general public interest – to help facilitate a functioning and representative democracy.

One of the reasons our nation is in the mess it’s in – where ideology rules and critical thinking is almost non-existent – is because the most educated in our society have chosen to be among the least involved. This is especially true in academia. Academic apathy often prevails.

The same was true of the Education community. I had worked for some 25 years in science outreach to junior high and high schools, via the Utah Science Center, The Leonardo, and my own earlier Center for Integrated Science

Education (CISE). The various state education organizations – the Utah Science Teachers' Association (USTA), the Utah Council of Teachers of Mathematics (UCTM), and the Utah State Office of Education (USOE) – ignored my candidacy and campaign. As noted earlier, they are indeed 'political' groups, as they are very afraid of our highly ideological and largely anti-science Legislature. They cower and submit by avoiding anything even remotely 'political'.

The Hinckley Institute for Politics at the University of Utah was very unresponsive. They weren't even curious. I think they basically assumed that any time spent on any but the two major candidates was a total waste of time. The argument that third party and independent candidates bring fresh ideas and perspectives to the debate simply did not resonate. They had no interest in third party or unaffiliated, independent candidates, although they did warm up a bit towards the end of the campaign.

After the 2012 elections were over, Hinckley Institute agreed to 'host' a panel discussion: Independent and Third Party Candidates in the 2012 Utah Elections – Role, Effect, and Future on Dec. 3, 2012. The event was co-organized by me and moderated by KCPW's Jeff Robinson.

## **Was my One Year Experiment Worth the Time and Effort?**

Yes, I think so.

My speeches, newspaper letters and op-eds, signs and cards, and personal interactions introduced words like sustainable, climate, alternative, renewable... to a population which rarely hears such words from their leaders and candidates. Most of the population is semantically sheltered and isolated – 'protected' from issues, concepts, and problems. I tried to break through the very right, conservative echo chamber in which most Utahns reside. As people hear these words spoken and written – by people and candidates which otherwise

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seem to be reasonable, informed, educated, and interested – the words will begin to seem less of a threat.

The 2,600 votes I received were only 1.6% of the total vote. I had hoped to garner 5 to 10%, or in the range of 10,000 to 20,000 votes. Had each of my voters worked on 5 to 10 friends to cast votes for me, I would have achieved that goal. The 5–10% range is important as one can then argue to be included in debates and other activities in which the ‘major’ candidates are represented.

Charles Kimball and I had very similar goals. Between us we received 5,000 votes, about 2.25% of the total cast. Kimball has suggested that his showing may have been due to the name Kimball – which is highly regarded among the Mormon electorate.

After the election I reached out to District 2 voters, County by County, with a letter to the editor, titled Thank You, [Specific] County:

Thank you for the xxx votes I received for the District 2 Congressional seat. I placed 4th in a field of 5. I ran as an unaffiliated, independent candidate with the goal of asking tough questions, challenging obsolete assumptions, and promoting common sense and reality-based solutions. I ran against money in politics and against fear, fantasy, and ideology. My one-year Experiment in Democracy ended on midnight Nov. 6. I lost, but winning was not the objective. The objective was to experience the process and work toward changing the conversation. That objective was successful...

Those xxx of you who voted for me, thank you – the future really is in your hands. Please run yourself – or strongly support and help candidates who work toward restoring our democracy.

I will not run again.

Please express your voices and positions loudly, clearly, and often to your new congressman and to our state government. If enough of you speak up, you will be heard. The times are indeed changing.

The Letter was published in many of the rural papers.



I had reached out to the youth audience via high school papers, Facebook, and Twitter – as well as via an event at Kanab’s Amazing Earthfest celebration in May, 2012. High school students submitted essays on The Future of Kane County and focused on Environment, Education, Energy, and Economy. The program was continued in May, 2013 with 35 submitted essays. Such events help communicate to students that it is their future we are discussing and that they need to be a part of the dialog and the discussions – including participating in the political process.

Although I only received 38 votes (5th in a field of 5!) in Kane County, I feel such events and activities are very important in mobilizing the new generation of voters. During the Earthfest 2013 event, we realized during the panel discussions that the current group of new voters for 2014 were born after the Grand Staircase Escalante National Monument (GSENM) came into being in 1996 – an event which older residents still denigrate – and whose memory fuels their continued opposition to Federal and public lands. Their kids don’t necessarily feel that way. These same kids in the next 10–20 years will assume leadership positions in their communities.

My rural Utah interactions, discussions, and experiences convinced me that most people know major changes are coming – they know their historical expectations are in flux. They are afraid of such change. They are afraid of the climate change they hear about and work to deny. They are afraid of impending drought. They are afraid of carbon fees or taxes. They are afraid of higher energy costs. They are... afraid.

Southern Utah’s State Representative Mike Noel was wise to worry about jobs for his 18 grandchildren, which is why he denies and denigrates the changes he knows are inevitable. He wants to put off the reckoning as long as he can – he wants the echoes in the chamber to resonate as long as possible. But he and the many other deniers do know, perhaps subconsciously, that change is inevitable. They will each eventually undergo their private revelations in their own time. My self-assigned job was to assist in that process.

The columnist Ellen Goodman said:

‘...change occurs when people learn what they already know.’

And Samuel Taylor Coleridge wrote:

‘So often do the spirits of great events stride on before the events...

and in today already walks tomorrow.'... quoted by Al Gore in his *The Future*, 2013.

And in Bob Dylan's words, 'the times they are a-changin'.

Rural and conservative Utah knows that, although, without real leaders, most will deny and oppose it as long as they can. Tipping points do happen – psychologically as well as physically. If Utah's Mormon leaders began to talk about climate change, about resources, about sustainability – most of the Mormon electorate would then have their own personal revelations. Their pioneer heritage and history is about frugality, inventiveness, doing more with less. Their more recent history is about materialism, rapid population growth and large families, large homes, large cars, well-paying jobs, and over-watered green lawns. There are Mormons who are environmentally conscious – who understand climate change, who support the rapid phase-out of fossil fuels. One group is MESA: the Mormon Environmental Stewardship Alliance. They are beginning to get a following and are resonating with Mormon youth.

The problem and challenge is time. Major climate and environmental tipping points are upon us. We no longer have multiple tens of years with which to help educate and 'engineer' private and communal revelations. We need more and more candidates, speeches, discussions, and activities which cut through the denialism, which disrupt the echo chambers, which engage and empower youth, which help drive those personal revelations which are so desperately needed.

My campaign helped develop an interest in third party and independent candidates via our late and limited protest actions. The media and other established, 'credible', recognized institutions basically ignored Charles Kimball, Bill Barron, and I. Unaffiliated candidates are even worse than third party candidates – we are spoilers – we simply want notoriety – we want a soapbox. We perform no useful function. Although they did not always say such things – they intimidated and thought them – at least until we got on their radar.

The 2012 Utah election, I was told, was the first election in which unaffiliated and third party candidates received some notice – largely due to my campaign's protest actions in October, 2012. As a result, such candidates will, I think, have a bit of an easier time with the media in 2014 – and I will do what I can to facilitate their access to the media and to the general public.

I summarized my one year experiment in the little book *The Run: My One Year Experiment in Democracy* (at [www.joeandrade.org](http://www.joeandrade.org)). Please distribute the document – it encourages people to RUN – and provides perspective and advice. Spread the word!

Win or lose, politics is a great sport, a wonderful process, and an inspiring institution. We must all work to make it better – and work for a truly sustainable and democratic future for all. YOUR Turn!

And, from the last page of *The Run*, via Cervantes' Don Quixote:

“Too much sanity may be madness – and the maddest of all – to see life as it is, and not as it ought to be.”

## Project 104

Continuing with my efforts to enhance awareness and interest of public officials in environmental issues and topics, in 2014 I launched Project 104: Facts, Fiction, Futures, and Vision – for Utah. 104 because the Utah Legislature consists of 29 senators and 75 house representatives. I recruited two USU and UUC students to serve as project interns, via a small stipend. I paid the stipend directly to them via personal checks.

The interns were to contact, via both direct phone and via e-mail, every one of the 104 legislators to get their input on a small set of ‘issues’ questions. Each intern dealt with half the senators and with half of the 75 representatives. I met with them weekly, first to formulate the questions and process, then to discuss their ongoing results.

The questions were, briefly:

Air and Health

Energy

Snow

Water

Growth

Education

Health Care

## Obrigado Pela Vida

EPA and Utah 'non-attainment'

Poverty and Homelessness

Other

We produced a master spreadsheet for all 104, tabulating their interest and, when available, their responses to the questions posed by and discussions with the inquiring intern. We then discussed the results.

Results were variable and mixed, as expected. Some details are at [joan-drade.org](http://joan-drade.org).

In my opinion, for those legislators who were successfully contacted and engaged, the exercise did make them aware of topics of which they were fully unaware, and of others they initially thought were not issues or concerns to them or to the legislature. I surmised, 'lacking any evidence to the contrary' (one of my favorite quotes), that our efforts did make some legislators more aware and perhaps more interested in environmental issues and concerns. We did expand the 'study' into the fall term to connect with a few candidates running in the upcoming elections.

I did not continue that project.

## **UPEC – Utah Population and Environment Coalition**

In mid- to late-2012 Wayne Martinson asked me to serve on the Board of UPEC. We had been interacting for years. After learning of his interests in the Ecological Footprint approach to environmental awareness, I contacted him regarding The Leonardo project, initially I suppose to seek financial support. He and his wife were connected to a small foundation which funded ecologic and environmental causes. Wayne himself worked with the local Audubon Society chapter. He had founded a group called the Utah Population and Environment Coalition in late 1997. They were working to make Utahns aware of the need for population awareness and education – advocating family planning, ecological footprints, and later carbon footprints. I, of course, resonated with such

interests and perspectives. The group had a basic website, a very small budget, and good ideas and goals. On the web site were two reports the group had commissioned and made available to the public:

The Ecological Footprint of Utah and  
the Utah Genuine Progress Indicator Report.

Wayne had drafted an RFP for a local media campaign which came to be called Small Families.

He had a small Board and wanted to add a little new blood and perspectives. He was interested in what we were doing – and had done – in bringing The Leonardo into existence. I accepted his invitation and became an active member of the Board.

After some discussions, a firm was selected, the ‘Small Families: It’s OK to Plan’ campaign came into being – including short pop radio spots on family planning – not a common subject in our parochial and semi-closed Mormon community. I helped with the web site, with fund raising, and with getting the group to submit for IRS 501C3 non-profit status. Jake Hanson, who’d been – and continues to be – working closely with me – helped with a new site, the non-profit IRS blessing materialized, and the Small Families campaign went on, as did a set of community events with UPEC tables and information on family planning.

About August, 2014 we worked with Mark Thomas, a local Mormon scholar and speaker who served on the Board for a short time, to update and expand a document he’d written earlier titled:

Truth, Population, and Mormon Symbolism: A Mormon Essay.

Copies were made available at UPEC events and on the web site.

In early 2014 I learned of World Vasectomy Day (wvd) and suggested UPEC and The Leo collaborate on an event for that day, along the lines of the Science in Society panel discussions The Leo had held for many years. Planned Parenthood agreed to lend their name as a co-sponsor. We collaborated with wvd organizers to show their film *The Vasectomist*, with a panel discussion to follow after the film – shown in The Leonardo’s third floor auditorium. We designed a poster and we did our best to get some media awareness for the event.

On Nov. 7, 2014, after an introductory reception, including a drawing for a free vasectomy!, I chaired a panel consisting of:

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David Turok, M.D., a family planning advisor;  
Susan Soleil, a woman's perspective;  
A Vasectomist's View via David Gonstrum;  
I presented an 'I've been Snipped' patient's view; and  
Peggy Battin, a UTU bioethicist, spoke on contraception statistics.

After our discussions we viewed the film, then spoke again briefly, after responding to questions.

It was a modestly attended event but did generate some awareness of and interest in vasectomy, family planning, and contraception.

I continued working with UPEC, probably into late 2015, then left the Board but continued providing input and modest financial support. The group continues: *utahpopulation.org*.

*And now what?*

What does a 70 year old retired, definitively defeated, Congressional candidate do next? Perhaps some Revelation Engineering!

# **State Change – On Revelation Engineering**

*What's Next? • From Abbey and Huxley to Revelation • State Change –  
The Premise • Shulgin, MDMA, MAPS • Prius to Pacific Grove • Changing  
States by Changing Minds? • Writing StateChange • Ecstasy in  
Manzanita • The harmless Team – Characters • Travels – 2013–2016  
• 'Publishing' and Releasing State Change • Legacy • Koestler, Huxley,  
and the 'Paranoid Streak' • Leonardo da Vinci • Carl Sagan • Rachel  
Carson and Silent Spring • Aldous Huxley and Island • Richard  
Feynman • David Suzuki • Christopher Hitchens • John Kerry • Onward •  
What's Next?*

I WAS ONLY 70 in 2012 – and reasonably healthy then. I would not be going to Congress. Perhaps there was still time to really do something effective, even significant. I recalled Steven Schneider's comment, pinching himself, after beating back deadly lymphoma:

“You're Still Alive... So Do Something!”

Barb and I were fully retired. Our kids were OK. Erma was fine in her new quarters. Manny was still a problem and needed some attention. The Leonardo

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was alive, even though struggling. *Science without Walls* was now over – although still available on line. The RUN was over.

And Barb had her new community garden focus. We had the financial resources to continue our travels and activities.

I had worked to foster critical and objective thinking, via the education efforts of *Science without Walls*, the Utah Science Center, and The Leonardo. I had tried to influence legislators and political ‘leaders’ directly – without success. And I had tried – for one year – active politics. I lost The Run, and did not run again. It’s too slow.

The public is so apathetic, ill-informed, ideological, and worried about immediate survival that democracy is seriously compromised. Gerrymandering and money in politics has made a very bad situation even worse. Our democracy has become too distorted to work.

The electorate is so polarized, along many of the lines I’d outlined in *The Call*. The RUN did teach me that The Right, the conservatives, the Mormons, live in constant fear that the world they have known is changing beyond their control. They attribute much of that to The Others, to our changing demographics, to our openness – in short, they no longer trust Democracy; they no longer trust one person, one vote. Although they didn’t call it that, White Privilege was their norm – they don’t want to give it up. They have slowly become pseudo-Fascists.

The right half want to keep out, avoid, disenfranchise, and otherwise eliminate The Others; the left half are far more compassionate and empathetic towards The Others. The separation has always been there. Individual autonomy, rights, and ‘freedom’ versus a more collective, societal, open, trusting approach.

Those years of working on media-based adult science education; on hands on, experiential, discovery via The Leonardo; and on engaging with our distorted, largely ineffective, and corrupted political system – they are not enough. More active and direct action is needed – beyond petitions, banners, and non-violent protest.



## From Abbey and Huxley to Revelation

Expanding a bit from Edward Abbey – we need to ‘monkey-wrench’ politics and politicians directly. We need to get the worst ones out, by whatever means, in the hope that they will be replaced by more reasonable men and, preferably, women. And we can also work to directly change those we cannot remove – to ‘engineer’ their own private personal revelations. Maybe.

John F. Burns, after 40 years with the *New York Times*, said:

‘I carried back...an abiding revulsion for ideology, in all its guises. ... there is no limit to the lunacy, malice and suffering that can plague any society with a ruling ideology.

Ideologues don’t listen, thus they rarely learn – and they almost never change. Most men, particularly ideologues, live in mental caves or tunnels’.

William Blake said:

‘...man has closed himself up, till he sees all things through narrow chinks of his caverns.’

The philosopher Thomas Metzinger says we exist in an Ego-Tunnel, constrained in part by our own mental development. Some of us have windows or semi-transparent walls in our tunnels – so we can perceive a bit beyond our parochial ideologies. But even those windows are generally barred by society, custom, laws, and expectations. Most of those bars are virtual – self-imposed. Revelations, epiphanies, Eureka! moments remove some of the bars on some of the windows – and can even open doors.

It was much later that I ‘discovered’ Arthur Koestler and his writings – his recognition of the ‘paranoid streak’ faultline in the human brain. I also discovered Aldous Huxley and his *The Doors of Perception*.

Most Congressional ideologues are now elected from heavily gerrymandered GOP districts, guaranteeing them easy re-election. Running against them doesn’t really help. Trying to educate their constituents only marginally helps. Karl Rove said – now many years ago –

‘He who controls redistricting can control Congress’.

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And they did. I now understand that getting ‘rid’ of the incumbents is unlikely to help, as other ideologically polarized candidates will be elected to replace them in the gerrymandered districts.

Compounding the problem is money – dollars. Most conservative ideologues are supported by – purchased by – plutocratic dollars. The Koch brothers, the DeVos empire, the Adelsons, the Mercers and many others spend enormous resources on sponsoring, supporting, and purchasing Congressmen and candidates, who then work to replicate the rigid, ideological mental states of their sponsors.

These many considerations led to my own recent revelation: if we can’t get rid of ideologues, can we ‘change’ them? Can we soften the walls, remove some of the bars – open some of the windows – even doors? Can we open, to quote Aldous Huxley, ‘The Doors of Perception’?

Revelation is a word and process very dear to the ultra-conservative Mormon majority in Utah. Although normally referring to direct input from ‘God’ to the ‘prophets’, Mormons as individuals have agency – and are expected to seek and receive their own private revelations – a significant change in personal understanding, belief, or perspective.

We use the word revelation in science education; we want Eureka! moments, we want to say ‘I get it!’ Good teaching has always fostered understanding, personal private revelation. If prophets can have revelations, if good science experiences lead to revelation, if Mormons – and others – indeed have agency, then why not Congresspeople, Mayors, leaders, elected officials?

Interesting. Could we ‘engineer’ private revelations for Congressmen and their staff, for candidates and their supporters, and for voting constituents – indeed for all?

And that became The Plan: the ‘engineering’ of mental revelations.

## *State Change – The Premise*

The first page of *State Change* is a Preamble, even a Manifesto:

The State must change.

National and World leaders are trapped in a set of assumptions which exacerbate the very problems which must be solved.

Replacing those leaders and rulers is insufficient, as their replacements will likely be afflicted by the same mindsets – based on the same historic assumptions.

The most effective, most pragmatic, most realistic solution is to directly change the mindsets of existent afflicted rulers and elected leaders.

Given the urgency of the problems which must be solved, those entrenched mindsets can only be rapidly changed by direct chemical means – by chemically-facilitated revelations and epiphanies.

I really don't recall when or why the idea to 'treat' mentally ultra-rigid brains began. I'd always been interested in neurochemistry, but knew next to nothing. I was concerned with drugs, with hippies and teens 'tuning out', with the 60s and the drug years, with the draft and the Vietnam protests..

I never tried anything, and never smoked. I thought about drug issues in the 2012 campaign, about depression, about shootings and guns, about death and suicide – but never personally. I'd known people on anti-depressants and related drugs, I'd known marijuana smokers, and perhaps some drug abusers, but I didn't seem susceptible to those urges or problems. But I did think a lot about it. Aaron, Tonio, and I occasionally would talk about drug-related issues.

Bob Huber was a UTU colleague in Electrical Engineering and a member of the 'local culture'. We'd occasionally complain with each other about Utah's demented legislature, the need for political education, the beauty and simplicity of revelation in Mormon theology and practice. We discussed the efficacy and efficiency of Mormon revelation, citing that 1978 revelation allowing Blacks to join the Mormon Priesthood. Suddenly, it was done. Allelulia!

So, one day, probably in the mid-90s, in the UTU cafeteria and perhaps during a lunch with Tom Stockham, that computer science/EE professor who invented and developed digital music, we cooked up a course, to be called Revelation

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Engineering. We considered how best to work with engineering students to develop their understanding of principles, to develop their critical thinking skills, and to enhance their individual creativity. These were the early days of our ideas for *The Leonardo* and for *Science without Walls*. We expanded our course outline, a bit in gest, to politicians, prophets, and leaders who could use some mental enhancement and expansion. The course was never offered, but we'd often joke about it.

Tom Stockham died of Alzheimer's Disease in 2004. Many years earlier, during one of our cafeteria encounters, I asked him if he had sensed any early signs of his impending Alzheimer's affliction.

"I began getting fewer creative ideas," he recalled.

Revelation Engineering stuck with me. The entire Mormon missionary program, and those of most Christian religions, depend on revelation – of sensing, seeing, believing in God. But revelation can work in the other direction – of moving from simple belief to critical thinking, to thinking for yourself. I wanted to help engineer revelations by opening doors and windows – by removing the bars to perception.

## Shulgin, MDMA, MAPS

The mid-80s were an important time for legal and illegal drugs. MAPS, the Multidisciplinary Association for Psychedelic Studies, was founded and chartered then, in response to the Federal Government declaring MDMA to be a Schedule 1 ultra-dangerous now illegal drug.

Dr. Alexander (Sasha) Shulgin, an organic pharmaceutical chemist working from his own lab in Lafayette, CA, had been synthesizing, self-testing, and writing scientific papers on MDMA, primarily for the attention of mental health practitioners. I never meet Sasha Shulgin. He died on June 2, 2014, just as I was beginning *State Change*. I did have the opportunity to meet his wife, Ann, at a MAPS conference in Oakland in 2017 – with a copy of the self-'published' *State Change* for her, noting its acknowledgement and my thanks to Dr. Shulgin. She died in July, 2022.

While not a psychedelic or ‘trip’ drug, MDMA (3,4-Methylenedioxy methamphetamine) seemed to serve to open and cleanse conflicted and rigid mindsets, allowing one to more effectively interact with others, and to consider alternate hypotheses and viewpoints – sort of to ‘derigidify’ the brain.

Unfortunately, the recreational drug community adopted MDMA as a signature drug and chief component of Ecstasy, a cocktail of drugs that became the basis of Raves – all night dance parties. The FDA then acted to add MDMA to its gross illegal list, thus stopping its production and legitimate medical studies. It remains illegal. Fortunately, MAPS and others have worked very hard to fund and organize studies which have demonstrated MDMA’s safety, efficacy, and applicability for a range of complex, difficult-to-treat mental issues and problems, including PTSD, depression, and related conditions. The drug is now in Phase 3 clinical trials, and expected to be approved for medical use, perhaps in 2023.

Why wait, I thought. Our democracy is collapsing, rotting from the inside. The world is heating up ever more rapidly, with the full complicity of all those profiting from it. We keep waging wars which compound all of our problems, the Earth itself is becoming uninhabitable, and we have populations suffering loneliness, despair, pandemics, and starvation. Really – it is that bad.

So why wait?

I’m not an organic chemist, but I knew some good ones. I’m not a real writer, but I’ve been reading some very good ones. So I read, studied, and tried to apply all I could to come up with a Plan. And that became *State Change – A ‘novel’*.

## Prius to Pacific Grove

Celebrating the end of the one year experiment in democracy on November 6, Barb and I decided to buy a Prius. We searched for a week or so, and purchased a new 2012 Barcelona Red Prius on Nov. 14, 2012 and took it home. Aaron would ‘inherit’ our well worn Subaru Imprezza, my wonderful campaign car. Although good on snow, it wasn’t good on gas. Our environmental credentials were instantly enhanced!

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Buying a Prius recalled a cool line from the even cooler TV crime show *Numbers*, which aired about 2006. The math genius's father, responding to an irate neighbor about his ugly, uneconomical pickup, responds by pointing to his son:

'He's got a Prius. We're covered!'

One Prius is all it takes to assuage our *mea culpas!*

And we wanted to travel and spend more time on the west coast. The Prius had lots of internal space, allowing us to pack and haul most of what we wanted for a comfortable stay in an extended vacation rental – in Pacific Grove or elsewhere. We packed computer peripherals, spices, basic foods, bed lamps, some kitchen ware, entertainment materials, and – in later years – air filters and our amazing fold-up mini-ping-pong table. We were largely self-contained and – in the rented vacation homes of others – quite comfortable. We were – with our kids' permission – spending their inheritances.

In late December, 2012, our new Prius was Christened on Christmas Eve by a young Muslim man turning in front of us on black ice. A nice, calm guy – he was uninsured. We let it go. But our pristine Prius would never be pristine again.

We then Prius-ed to the Coast, to be with Blauers on New Year's Eve in Los Angeles – Redondo Beach. We hiked and picniced in Palos Verdes and celebrated the new year on the beach. On New Year's Day we visited the wonderful Arsalans in north LA, meeting Mary's daughter, Nadia – the first Arsalan grandchild.

We drove up the Coast staying in Santa Barbara, then visiting Cambria and the San Simeon elephant seals, then up the Big Sur coast to Pacific Grove. We and Aaron visited Erma in her still new abode in Fremont, we all Skyped with Tonio and family in Decatur. Jill and Scott joined us in Pacific Grove in our yellow rented home – the Nylan House, right on 7th St. Then the plumbing backed up; I had to help the plumber unplug the main sewer drain, we aired out the house, and learned something about plumbing and sewer issues in Pacific Grove. Jill, Scott, Aaron rode bikes, we 'discovered' Sea Harvest restaurant in Carmel – thanks to a tip from the Hibbs, who often spent a week in February in Carmel. And we walked and walked in Pacific Grove and on the magnificent Coast Trail.

We enjoyed the stay so much that we extended it for 4–5 more days by staying at the ‘Best Western’ Monarch motel on upper Lighthouse Ave., near the Monarch Sanctuary.

And I read. We read. Lots of books, preparing for my new writing project. Aaron had introduced me earlier to Aldous Huxley’s *The Doors of Perception and Heaven and Hell*. Fascinating. And I began to read about authors and books that fostered and inspired revelation, agency, and actions.

I became very interested in Steinbeck, his interest in science via Doc Ricketts, his concern with social injustice, and his skills at observing, perceiving, and writing. I studied the structure of *The Grapes of Wrath*. I read his Nobel lecture, and his last book – *America and Americans*, 1966.

I read Huxley’s last work, *Island*, which, together with *The Doors of Perception*, became a justification, a foundation, for the design and writing of *State Change*.

## Changing States by Changing Minds?

*State Change* begins with Eleusis and the Greeks and the idea of Revelation, proceeds to define a Plan to facilitate private Revelation, and introduces a team called harmless to implement The Plan. The team develops the capability to produce sufficient quantities of MDMA for the Plan, identifies 29 subjects – politicians and others – who need to be ‘treated’, and then organizes harmless to deliver the ‘medicine’ for the treatments. It’s a largely fictionalized account of a plan which, if carried out, would likely be fairly effective in indeed changing rigid minds – a plan to help ‘engineer’ a national revelation.

From the Preface:

*State Change* develops a fictional team of like-minded friends, called harmless. Harmless selects and identifies a set of current political and public figures whose ideologies, actions, writings, and statements are doing, in our opinion, grave damage to our nation, our society, and our

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planet. Harmless ‘diagnoses’ such individuals as evil. We provide background on their needed ‘treatment’ – they become our ‘patients’.

We use their real names – they are public figures. Many are public celebrities. We assume that they are indeed treatable – and formulate scenarios, strategies, and methods by which to access and to ‘treat’ each of them.

I wanted to treat real people, use their real names, and photos (on the cover). I wanted to profile each one, their family, education, politics, and rationales for behaving and voting the way they have. I wanted to set the stage that their closed and rigid minds would be aided by a dose of MDMA – even a clandestine dose.

The Preface continues:

The harmless team willfully and intentionally breaks existing laws. Many of the laws they ‘break’ are counter to the principles of the United States Constitution and the international and regional declarations of Human Rights. Such laws should not exist and, in harmless’ opinion, deserve to be disobeyed and broken – they deserve to be ‘resisted’. The other illegal action desired and advocated is the ‘treating’ of ‘patients’ whose political and economic actions are contributing to the destruction of humanity and of its planet – the treating of madness. ...

*State Change* is my wishful and fanciful thinking. It is my hope and goal that its readers may be stimulated and empowered to take their own actions. It is my contribution to non-violent resistance against the current political situation in the United States – and beyond.

I self-published the book because I did not want to deal with photo copyright issues or other constraints imposed by normal publishers, even Amazon listings at that time (Spring, 2016). I was preparing and planning to literally ‘drug’ 29 public figures, albeit for their own and society’s benefit. I was fully prepared to get negative feedback.

Nothing happened. The website we set up: [www.statechange.us](http://www.statechange.us) – has had few hits and fewer downloads of the free book. I doubt that more than 100 people have read the book since it was released and made available in April, 2016.



Too much was going on in 2016. I dismissed Trump in the book, for example, by saying his ‘brain’ was untreatable, even via MDMA.

“And the 29?” Bill asked. “Where did the magic number come from?”

“My little idea to give recognition to Shulgin and MDMA – 14 big atoms – carbon, nitrogen, oxygen – plus 15 little ones – the hydrogens.”

“And that happens to be a prime number – and a prime empathogen,” Bill smiled.

Many of those 29, some seven years later, are still in office and still committed to political evil. That’s not the fault of my plan or of MDMA. That’s just how bad the world and politics has become.

The book will continue to be available. I’ve continued to Tweet and email about the book, as I believe the plan and approach are still valid and potentially useful.

## Writing *State Change*

Writing *State Change* was my major activity from 2013 through early 2016. I really wanted it to serve as a handbook of sorts, stimulated in part by Dave Foreman’s 1986 *EcoDefense: A Field Guide to Monkey Wrenching*, inspired by Edward Abbey’s novel, *The Monkey Wrench Gang*, 1975, 1985. Abbey died in 1989. The philosophy of constructive sabotage became important to me once I realized that standard ‘nice’ socio-political approaches simply don’t work in today’s ‘culture’ and environment.

*State Change* is in four parts – a very simple structure and design:

The Challenge

The Methods

The Patients

Treatment and Outcomes

each containing several chapters.

The CHALLENGE section covers my concerns, a historical perspective on revelation, and the nature of the harmless team. METHODS covers the chemical aspects. We selected MDMA as the most effective agent, discussed and selected

means for its synthesis, manufacture, and means to test the MDMA preparation for efficacy and safety. I also discuss our criteria for ‘patient’ selection. THE PATIENTS is our process and choices for actual patients, derived from four groups:

- Supreme Court Justices
- Presidential Candidates
- Congress – Men and Women
- Plutocrats.

We select 29 high priority ‘patients’, and identified 74 more readily accessible second-priority patients.

The final section, TREATMENTS AND OUTCOMES – covers the strategy and methods for delivering the clandestine treatment and how we might assess outcomes and results.

The book concludes with a brief perspective on where do we go from here.

## Ecstasy in Manzanita

The year 2013 allowed me to study and encounter ‘ecstasy’. In summer 2013 we routed via Denio Junction in the Subaru to Lakeview, Klamath Falls, Crater Lake, and Portland.

Then again to Susan’s Beach Cottage in Manzanita – the piano was still there! This time Elaine Jarvik, a close SLC friend, and her Portland family would be visiting us in Manzanita. Their daughter, Ravenna, was Amalia’s and Sylvia’s age, and they hit it off very nicely. Elaine’s grandson was a student at U of Oregon, in Eugene, and was known to have experimented a bit, as had his parents earlier. It turned out we learned that some of our own extended family had tried some ecstasy prep many years earlier.

I ‘interviewed’ the grandson as to his experiences and perceptions with ecstasy. He and his parents basically confirmed what I’d been reading. I also learned, while walking on the Reed College campus in Portland, that there was an active student group that provided tools for testing of psychedelic and related drug pills, with a locker near the student union post office.

We returned to SLC by plane, leaving our loyal Subaru with its new owner, Aaron. Barb immediately got to work on her community garden plot and on our own garden. And I continued to write *State Change* for the next several years.

## The *harmless* Team – Characters

The idea of the harmless team was stimulated by the 1971 burglary of an FBI office in Media, Pennsylvania, which was kept largely secret for decades. It was all exposed and told by Betty Medsger in *The Burglary*, a 2014 book. The story was dramatically told in the film *1971*, released in 2014. The eight Media ‘burglars’ kept their actions largely secret until 2014, some 40 years later! They had pledged a vow of secrecy until the end of the statute of limitations.

Jay is ‘modeled’ on Ray Wheeler. We met in early 2012, at the beginning of the Farmers’ Market season. He was shopping at the People’s Market around 900 West and 1300 South, near the International Peace Gardens. I was looking for votes as I had just qualified for the 2012 ballot as an Independent. He listened to my pitch, liked it, and wanted to help. He had just retired from the UU Facilities group, had acquired a new video camera, and was enjoying using it. He supported and helped me throughout the 2012 campaign. He was clearly politically interested and motivated.

Bill is Hugh Bollinger, who I’d worked with in The Leonardo project. I met Hugh via Mary Tull. Hugh and I had common interests and grew to become close friends. Perhaps five or so years ago we started meeting for lunch every two weeks or so to discuss politics, climate, and environmental topics. Hugh has gotten to know many, many people during his long career. He is an excellent ‘connector’, ecologist, and plant biologist.

Tom is Don Gregonis, now deceased. Don joined my research team at the UU in the late 70s as a synthetic organic chemist. He was the ideal model for Sasha Shulgin, the chemist who made and tested MDMA. Don and I worked together for many years. We continued to meet sporadically after he left the UU;

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we met and reminisced occasionally with our mutual friends Dennis Coleman, Lee Smith, and Jim McRea. Don died of neuroendocrine pancreatic cancer on August 10, 2016, just months after *State Change* was released. He did see a copy before he died.

Peter is modeled after Scott Newcomb, Jill Williams' partner, husband, ex-husband, and now friend. He resides in Portland, travels often to Amsterdam, and is the most chemically experienced of the harmless team.

Lucien is modeled on my son, Aaron, who also resides in Portland. The youngest of the harmless team. He and Scott are likely the only folks on the team to actually have some experience with psilocybin and MDMA.

As the idea for the book come together, and after I'd identified harmless and its members, I asked each team member if they'd like me to use their real names, or a pseudonym. All chose the first name pseudonym noted above. I was the only one who as narrator and organizer consented to my use of my real name.

## Travels – 2013–2016

April, 2013 Barb and I were off to Folly Beach again, via Charleston. During that visit I discussed the early plans for the book with Tonio – and with Andrea. They each had had some very limited experience with chemical agents.

In late April – early May Barb's cousin Pat Arnow and her partner Steve met us and the Mandas at the SLC airport. They wanted to see parts of Southern Utah. So I put together an itinerary for us, booked rooms, rented a van – and we headed south. We experienced Arches, Torrey, Boulder, Calf Creek Falls, Escalante, Bryce, Zion East and West. A good time was had by all.

In May we two were off to Kanab and Amazing Earthfest. Rich Csenge and I had organized a high school essay contest titled: 'The Future of Kane County'. Rich and I felt the adult residents – and their leaders – might benefit from hearing from their own students and children. There were 35 entries – and five 'winners'. The event was well summarized by the local *Southern Utah News*.

Mid-July was Manzanita with our old Subaru, routing via Crater Lake, then Portland. While there for a few days, Barb and I went into a coffee shop with

live music. There was a Brazilian-themed trio playing. We really enjoyed them. They were not very well known then and lived in Portland. I had the crazy idea of contracting with them to play for a few hours at our next Oregon family gathering. They were interested – it seemed reasonable. I offered \$500. They accepted!

Manny was an issue again in August – September. I attended a hearing, probably in Oakland, dealt with his landlord, who, as I vaguely recall, evicted Manny for doing auto repairs in the front room of his apartment. We got through it – moved on. In early October Brother Bob and wife Joyce were with Erma in Fremont. I was also there, probably to sort out Manny issues.

It was Atlanta in mid-October to be with the girls, Andrea, and Tonio. We walked, played, visited botanical gardens.

Our 2013 winter escape started around Thanksgiving. We drove direct to PG via Fernley. We rented a small studio in Pacific Grove – just one block from the coast – from a Mr. Rohloff. My serious reading, in preparation for writing *State Change*, continued. We walked.

We spent an early Christmas, 2013, with Erma and Manny in Fremont. Later we hiked in Pinnacles National Monument, rolled on south to San Luis Obispo, spent Christmas Day on Bishop's Peak, and Dec. 26 with Arsalan's in north LA. New Years was again with Blauers in Redondo and Hermosa Beach. The Neymes were also there this time. We talked with Fanny Guadeloupe Blauer's mom in Mexico City via Skype, visited the La Brea museum in LA – Dylan Neyme had a friend on staff who showed us around. We then routed north again, stayed in Carpenteria, explored the Big Sur coast and parks. We stayed in the 7th St. townhouse, adjacent to the Nylan house we'd rented the year before...

Aaron joined us in early January, 2014. We hiked in Garrapata and went whale watching on a boat in rough water. Rhys came by in late January for a brief visit – and Barb's birthday. Barb got a birthday balloon recognition at the local senior center where we occasionally caught lunch. We saw Erma and Manny several times.

In early February we headed south again, staying in and enjoying Cambria for a day or so, then near Carpenteria, we headed East, to Palmdale, viewing Devils Punchbowl, then to Las Vegas. Red Rock Canyon in west Las Vegas was

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a brief hiking location, then St. George, for more short hiking, arriving home Feb. 9, 2014.

And I kept scanning – mainly old photos and slides, contributing to what is now (10–2022) a 15,000 photo library!

April 2014 was another Folly Beach event, this time with Aaron. We walked, played, did handstands (they did), celebrated Josie's third, hunted for shark teeth, and ate. Aaron flew back to SLC with us. We then hiked nearby Grandeur Peak, which still had some spring snow.

After the July 2014 Manzanita get together, we were at the Manda's home, doing a small 'block' or neighbor buffet potluck party – in the driveway of Mandas and their neighbor. Antonia had just celebrated her 65th birthday several months before. And I'd celebrated my 73rd, on Mt. Olympus, just several weeks earlier. So we all celebrated.

The Brazil trio arrived, set up, played. It was great. We danced. Amalia, Sylvia, and Josie were great fans of the famous song from *Frozen*, 'Let It Go', at the time. We handed them the microphone and talked them into singing it for us, with the guitarist providing some strumming back up. Really cool!

Barb had been working on her PCV memoir, which she titled *Innocence Abroad*. She'd take letters, photos, and files to Pacific Grove and worked during our winter stays there. I scanned nearly all of her materials so we'd have digital files and near immediate access to everything as she wrote the text and developed the project. She wanted to fully illustrate it. The project was collaborative with her PCV partner Becky Rabanal.

Becky took the train to Salt Lake City in September, 2014. We picked her up at the Amtrak terminal downtown. They met, talked, reminisced and worked for a few days, before Becky returned to Grand Junction, again via rail. They always have a great time together. The little book slowly grew and fully materialized. More on it later. We also learned about Becky's unique family history – orphan, adoption, education – and how she met her husband, the remarkable Jose Rabanal.

In October Barb and I flew to Atlanta to granddaughter-sit for a week, while their parents traveled to Dominica to celebrate their 10th wedding anniversary, Oct. 16, 2014. We had a great time. The girls said and waved an enthusiastic goodbye to their parents, but were of course delighted to see them a week later.

Josie and I explored the local library and perhaps learned a lesson or two. We sometimes quote Josie's plaintive:

"We've been here a very long time."

A cool little story.

Later that month Aaron met us in Salt Lake, then we three traveled to Paris and Toulouse, France to stay with the Hibbs at Francoise's family home in Garrot, near Roquecourpe, just east of Toulouse. We rented a car in Toulouse, Aaron was our designated driver. We found the Hibbs and spent a delightful week or so with them visiting, eating, walking – and even some working. They have a large stream adjacent to their home, which requires regular clearance of logs, brush, and debris. We visited Albi with them – also Castre and other sites. We learned of the Druids and Celts and the ancient history of that fascinating region. Barb and Aaron enjoyed speaking French. I nodded a lot.

From Toulouse we flew to Lisbon and the Rossio Garden Hotel – to do a pilgrimage of sorts to revisit our Fulbright stay days of 1979, when Aaron was nine years old. We were pleased to find Barbara Andrade, Realtor, A Venda (For Sale) signs on several properties in Lisbon. No relative. We then trained up to Coimbra to the same Hotel Ibis where Tonio and I had pilgimaged in 1995, on a similar visit. We ate, drank *galão* – Portuguese *café au lait* – and explored Aaron's (and Tonio's) former elementary school on the hill above the University of Coimbra. The school sported a large banner: Ha 52 Anos de Educar! We were so pleased the school was still in service. We walked in and looked around. Aaron remembered some of his lessons and adventures there.

We were in Coimbra during some graduation festivities of the U of Coimbra. In the large public garden between the Universidade and the elementary school, where we would meet and eat lunch back in 1979, there was a class of Journalism students, wearing class T-shirts. And a class of women law students, who felt the need to serenade Barb. We learned that it was a ritual or initiation custom for all graduating lawyers – to serenade a foreign visitor. Barb was the lucky one that day. They were sweet, attentive, sincere.

We visited the Residencial Infantil de Henrique – the *pensão* where we stayed some 35 years earlier – and the immense cemetery on the hill above it. We walked the main Coimbra shopping streets, where we would order and eat *frango* – Coimbra's signature and inexpensive fried chicken.

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Then it was off to Paris – Orly, staying at an IBIS hotel near the Gare d Lyon for three days. We did Paris – Eiffel Tower, lots of walking. On Nov. 5 it was back to Utah.

We rounded out the year back in Pacific Grove in the townhouse with the magnificent views. We visited Erma and Manny in Fremont. Manny agreed to assume responsibility as Erma’s major caregiver. He was eager to make up for being such a problem kid and adult. He was now older, mellower, certainly wiser, and genuinely concerned about her. He would be living with her fulltime as her primary caregiver. In early December Erma was moved into a 1 bedroom accommodation; her studio was just not big enough for the two of them. Erma had the bedroom; Manny slept in the living room area, and set up his music and electronic projects in a corner. He didn’t really have much personal stuff. They both made it work. Thanks to Manny’s strong recommendation, Erma acquired a quality recliner, which made her life less painful and more comfortable.

Barb and I were joined by the Blauers and the Neymes. Their kids really enjoyed the ‘small kids zone’ we defined and constructed underneath the inside stairs, while their parents, Barb, and I acted silly until midnight.

Barb continued working on *Innocence Abroad*, I continued writing *State Change*, and we walked and walked and walked. A very full year.

2015 began with Neymes and Blauers. Fanny and Barb did some exploring together. Early January Tom and Judy Hogan visited. We didn’t walk much as Judy is tethered to oxygen, but otherwise doing well. Mid-January we routed North to Petaluma, to The Metro Paris-themed hotel, then to Pat Carroll’s place and then on to a local botanical garden: Quarry Hill Garden. I searched for and found several sassafras saplings – a key ingredient in *State Change*. Back in Fremont Erma showed us her new recliner – it really made a difference – easy to adjust, get in and out.

Days later former student Sasha Hattori (PhD, 1980) visited us in PG, driving her cool Miyata from her residence in Sunnyvale. Barb and Sasha connected with their rocky coast and tide pool interests. They explored the ‘world’s greatest tide pool’ at Point Pinos, named and used by Doc Ed Ricketts (of Steinbeck fame). I watched, thought, and even wrote.

On Barb’s birthday, Jan. 25 (her 73rd), I picked up a sweet surprise – an internet bought-by-Tonio chocolate birthday cake. We celebrated in the townhouse, watching for whales through the second floor bedroom window, and



reading her birthday card and note – from our granddaughters. She then worked on *Innocence Abroad* and I worked on *State Change*. A week later we were in Big Sur's Pfeiffer State Park for our anniversary, the 52nd. And then back to Salt Lake City and home, via Winnemucca, NV.

In April we were back in Folly Beach with those delightful granddaughters – and their parents. We walked, played, and explored the beach, ate popsicles and food, celebrated Josie's 4th birthday, and read and talked.

Then in SLC Barb attended a party with her Chicas Amigas for Fanny's Mom, Maru – and other parties followed – Putti, Sunny, Carmen. They do enjoy getting together! Lots of gardening. Barb's community garden plot had a good crop of Portuguese fava beans. Mt. Olympus beckoned for my 74th birthday, returning via the Bonneville Shoreline Trail connector into Olympus Cove. Then it was off to Manzanita and Susan's cottage in late June.

I attacked a parked Subaru in the Starbucks parking lot near Aaron's place – making our Prius far less pristine. No serious damage to either car other than body work. Curses! The Subaru's owner was gracious and understanding. She said her car really could use a paint job. Her State Farm and our Farmers Insurance cut a deal and both cars were fixed, but with a high deductible for our Prius.

Oswald State Park was great, and especially the Cape Falcon trail which we knew and loved. Sylvia entertained us with a set of hand stands adjacent to the cliff at Cape Falcon. Great photo material. One day we went to the Tillamook Air Museum. Josie satisfied some of her pilot and flying interests by sitting and working in several cockpits. In Wheeler we took a steam train for a short ride. We cooked, cake decorated, and just enjoyed all being together.

Back in Portland at the city park across the little street from Jill and Scott's home, we all rode and assisted with a 4 wheel CrazyCart that would carry the littler ones down a hill at almost breathless speed. Then we'd haul the cart back up and roll again.

We returned to SLC via Madras (shop with good selection of Portuguese wines!), Bend, and probably Lakeview and Denio Junction.

In September we rolled to Denver via Laramie WY to see Aaron Wood, Barb's Prime Movement (an RDT course for older folks) dance instructor, then Ft. Collins to see Nina and John, then via Denver to Evergreen for the Rabanal's 50th anniversary celebration. The Sweeneys were also there.

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Back in SLC the Blauers had a cool costume party for Halloween. David became Heidi and I was Joanna, a Nevada brothel madam recruiting in SLC for young, inexperienced Mormons. All summer and fall I kept scanning old docs, photos, etc. For Halloween Barb put up one of her farmer or scarecrow Halloween creations.

Thanksgiving was with Mandas, et al. in Portland. We rented a little house in the Sellwood area, on Ogden St. We were trying on a Portland winter. The kids were starting to be concerned about our age and potential future immobility. We all talked about our moving to Portland, to be near Aaron and the sisters.

It was a very long, cold, dark Portland winter. Fortunately much of the time I could walk and bus ride to Reed College where I researched and wrote major parts of *State Change* – in the Reed Library and Student Union. Reed was midway between Aaron’s place and the Manda’s home. I used Reed as a setting for parts of *State Change*. Tom and Lucien’s chemical synthesis cottage was right around the corner from Lucien’s (Aaron’s) place. After the chemical work was completed, Peter and Lucien deposited our MDMA synthesis chemical wastes in the Reed Chemistry building – they’d know what to do with it.

We spent Christmas, 2015, in our Sellwood cottage – with Mandas, Jill, Scott, and Aaron. We wanted to be at the coast for a few days before heading south to Fremont and Monterey. We booked a small house (Latitude 45) in Manzanita for a few days, including New Year’s. There was room for some family.

We woke up on Dec. 28 to a thin film of ice all over. We walked the few blocks – very carefully – to the beach and saw ice there. How can salt water freeze? We realized that the vapor isn’t salt water, and water vapor freezes when it touches rocks and sand that are below 32 F. It was special and magical.

The drive south was slow and careful. We were stopped for a while while road crews sanded and treated the black ice on us 101. We stayed in Bandon that Jan. 3 evening, ate and listened to live music at Angelo’s there, and enjoyed Bandon’s beaches and waysides. Barb and I had a lot of time to talk. We concluded no to moving to Portland. Winter there was dark, damp, cold, depressing. The dark, narrow streets made driving somewhat dangerous, especially for 75 year olds with less than perfect vision and slower reflexes and mental processing skills – especially me. We can visit, rent, but not be fulltime residents. Our family was wonderful, but our friends were in Salt Lake. We couldn’t just move away from them. Barb felt this more strongly than I did.

The first few days of 2016 were on us 101, headed to Fremont. We spent a night at Garberville's interestingly named Sherwood Forest Motel – in the redwoods. It was winter, of course – dark, damp, musty, almost creepy. Probably a good summer location.

We saw Erma and Manny on Jan. 7, Erma in her recliner and nearing the end of her 95th year – she would be 95 on March 26. She smiled and entertained, but she was clearly drained, weak, and tired. A week later Fanny Blauer was with us for a week. We hiked in Garrapata State Park with its delightful small redwood grove in Soberanes Canyon. We were staying in a small duplex in sw Pacific Grove, near Asilomar. We then moved to the townhouse with a great view. David Blauer, with Danny and Juliette, met us there for a few days. The four Blauers then packed up and headed out to go to Thailand! What a family – what a carbon footprint.

Barb and I explored Wilder Ranch Park, just north of Santa Cruz. Later we celebrated her 74th birthday at the famous Nepenthe Restaurant, just south of Big Sur. Back at the Townhouse early one morning we got a call from Manny or Debby – Erma had fallen and was at the hospital. The details are back in Chapter 11. After a few days, thinking her semi-stable, we returned to Salt Lake City, acknowledging our 50th wedding anniversary on the way. Barb and I were in SLC in mid-February with our 'daughter' Nina, visiting from Ft. Collins, CO.

As we were having lunch, I received the call that Erma had 'passed'. When asked why, what happened, the attendant said simply 'She's gone.'

Erma had already made and paid for nearly all her 'arrangements'. We simply scheduled the 'viewing and vigil', the funeral mass service, the burial, and her celebration of life reception at Merrill Gardens. We bid her goodbye on Feb. 19, 2016. Aaron, Tonio, and I participated in the funeral. Bob and Joyce drove in from Louisiana – and then quickly returned.

I had not been to a Catholic funeral for many decades. I was of course thinking of *State Change* while thinking of Erma and her life. I thought of little white wafers in Communion; I thought of the incense smoke and scent during the formal burial Mass; I thought of death – Erma's, mine, and Don Gregonis' – the Tom character who dies in *State Change*. I used the funeral and death experience from Feb. 19 for the final completion of *State Change*. Erma was, of course, watching. She was now one of those silent voices in my mind.

# ‘Publishing’ and Releasing *State Change*

By early January 2015 I had a rough draft outline of *State Change*. I had selected most of the 29 priority ‘patients’, or perhaps ‘subjects’, for treatment. We (the harmless team) had already selected MDMA as the agent of choice. We were accumulating sassafras and studying Shulgin’s methods to synthesize MDMA. I had looked into ways to characterize and purify the product. We’d selected chocolate as the means of clandestine delivery.

I knew I wanted to specifically identify our 29 subjects (targets?). I didn’t want to mask them in libel-proof characters or caricatures. I wanted to study each, their family, their history – I wanted to address why and how they were so rigid, so uncompassionate, so evil. I knew I could never get their permission to do so – or to use their photos. The online printing service Lulu said I had to affirm:

‘...you have obtained the written consent, release, and/or permission of every identifiable individual who appears in your Content to use such individual’s likeness...’

Their Createspace content agreement said:

‘Celebrity images and/or celebrity names cannot be used for commercial purposes without permission of the celebrity or their management’.

My 29 patients were all public figures, even celebrities. Rather than fight for the First Amendment, I said to myself, ‘You’re 74 years old. You can afford to go to jail, as did Tim deChristopher.’

I recalled James Hansen writing and saying:

“At my age I am not worried about having an arrest record.”

So I looked for a way to self-publish and self-distribute without Amazon, Lulu, or other commercial self-publishing services. I didn’t think I could have success with any regular publishers, even the gutsy ones. Fortunately, I had been looking in to self-publishing for some time. I learned that the UTU Marriott Library had acquired, several years earlier, an Espresso Book Machine (EBM) – ‘a fully integrated book-making machine that can automatically print, bind, and trim on demand at point of sale perfect-bound library-quality paperback

books with full-color covers (indistinguishable from a book on a bookstore shelf) in minutes for a production cost of a penny a page’.

It was housed in the Reserve Book area of the Library – an area and service with which I was very familiar. I went and took a look, talked with the reserve librarian, got a tour and demo, looked at the paperwork required, and concluded – this will work!

I had already decided to make the finished book freely available online via a special new website: [www.statechange.us](http://www.statechange.us). I didn’t need many hard copies – perhaps 40 or 50.

Aaron agreed to do the design and layout. Literary friend Karen Sweeney agreed to lightly proof-read the manuscript. I paid several people to read and critically review the draft, including the Jarvik family and an online book draft review service. All that input was used in the final draft.

Aaron and I worked hard on the cover. The 14 faces on the cover are arrayed as a molecular model of MDMA – representing the C, N, O atoms. The additional 15 faces reflect the 15 H atoms in the molecule. The total, 29, is a prime number. Nerds like me think such connections are cool. The white and red horizontal stripes were Aaron’s idea – a taste of patriotism – after all we are trying to change our political state in order to save the nation. We chose to subtitle the book *A Chemical Fantasy*. In retrospect I do not think that was wise – most people who see the title and subtitle simply dismiss it as low level science fiction. *C’est la vie*.

I finished writing *State Change* on March 30, 2016. Once we got the final PDF to the Espresso service, the book was printed and delivered in a matter of days. The Preface spells out clearly and briefly its goals, strategy, and need. Jacob Hanson developed the website and continues to update and monitor it. The site went online in mid-April, 2016. Do look at it at [www.statechange.us](http://www.statechange.us).

I then got to work trying to let the world know the book exists. I sent e-mails to everyone mentioned in the book, with the PDF copy attached. I wrote letters, Tweeted, spoke up.

At first we kept a counter on the site to assess the numbers of visits and downloads – site analytics. Our guess is that only several hundred people likely acquired the file, and even less read it. I continued to make the social media world aware of the book – e-mailing and Tweeting all whom I thought might be interested in it or who could be helped by it. After perhaps thousands of such

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actions, I received only a handful of replies. I think I can safely conclude that *State Change* has had no substantial effect – on anything. I still think it was – and is – a very good idea and even plan. I wish I had been sued – at least that might have generated some publicity!

In the last few pages of *State Change*, character Bill says:

Albert Hofmann made a wish – at his 100th birthday celebration:

‘I would like to see the creation of a modern-day Eleusis, where seekers can undergo transcendental experiences with sacred substances in a safe setting.’

“Perhaps at Esalen,” I said. “If it does become legal, it’s reasonable to expect Eleusinian-like labs and ceremonies in college seminars, workshops in places like Esalen, and maybe even training sessions for newly elected politicians.”

“I think I’m getting your optimism,” Jay said.

“Enough.... No celebrations, no Tweets, no congratulations,” I said. “Keep it secret, just like the Media burglars did.”

“And maybe I can star in a documentary in 2040 – titled 2016,” Lucien said. “I may still be here.”

“And the rest of harmless likely won’t be there,” Bill said.

“I’ll now start working on *State Change: Act II*,” I said. “But this time I need to work solo.”

“How about another hint – beyond just saying it’s about evil?” Jay asked.

“It’ll begin with explosives – bullets and armaments – and the evil folks who profit from them,” I answered.

And that was it. *State Change* was over.

I am now working on a sequel – perhaps to be called *Removal*. But maybe: *No Man, No Problem*.

## Legacy

Concerned, at 75, with my impending mortality, and knowing that, eventually, Entropy Wins! (that's on my license plate holder), I began to think deeply about legacy – about preserving my work and ideas. I thought about writing a memoir – something summarizing and balancing my family, social, and technical lives. But for whom? Yes, for Aaron, and for Tonio and his wonderful family – especially our granddaughters. Anyone else? Most of our friends will leave the planet about the same time we do – they won't be here to read anything. I discussed this with the kids. In Folly Beach Tonio and I walked the beach, discussing future, legacy, mortality, and other cool subjects. Aaron and I have had similar discussions.

I also wanted a legacy website – where everything worth saving is saved – in text form. Just in case... someone out there, in the future, wants to study any of my work and ideas. There are a few books and technical journal articles that will be accessible via archival libraries, but most everything else will be composted – together with my slowing brain. I also wanted the legacy collection for me to use in writing the memoir, in remembering stuff in my older age, and for directing others to those wonderful materials.

I'd been collecting quotations for some 60 years. Whenever I read something I felt was interesting, significant, memorable, I'd type, dictate, or cut and paste it into a growing Quotations file. I also used it for short summary notes of papers and books I'd read. It became a great resource. I could look up the writer's name and search the file for key words to lead me to the specific quote. The Quotation and Notes consolidated file is now about 30 MB.

So I decided to try to do both – the Memoir and the Legacy website. The book you're reading is the Memoir – a record, a celebration of my life – and my thanks for it.

Jake and I are working on the Legacy website. It began many years ago with my registration of the URL [www.joeandrade.org](http://www.joeandrade.org) – and my efforts to get a Wikipedia page, which I did via a guy in Pakistan who solicited my interest via an email titled 'You should have a Wikipedia Page'. I agreed. Take a look: [https://en.wikipedia.org/wiki/Joseph\\_D.\\_Andrade](https://en.wikipedia.org/wiki/Joseph_D._Andrade). Later we added a Quotations and Notes tabs to the website. They're all there, at [joeandrade.org](http://joeandrade.org).

Jake Hanson has done all the work on my various sites and URLs, focusing on the legacy site – [joeandrade.org](http://joeandrade.org) – since early 2016. Our goal is to make it easily searchable, stable, easily distributed, and long-lived. Mark Twain didn't want his autobiography published until he'd been dead for 100 years. I'd like my stuff to be available and accessible during the next 100 years – maybe longer!

## Koestler, Huxley, and the 'Paranoid Streak'

We continued 2016 with the summer week in Manzanita, OR. Hiking Neahkahnie Mountain required a bit more care, but was easily accomplished. Just before that I did do my annual Mt. Olympus birthday hike. I had done some 'training' for the hike in May and June, but it was still slow and grueling. Guess I'm getting older.

Tonio, Aaron, and I, while walking, discussed the future, including mortality and incapacitation. What to do if/when Barb and/or I become dysfunctional, incapacitated, or severely compromised. Barb and I have each decided on no heroic measures – we have read, signed, and posted the standard Advance Health Care Directive, similar to Erma's POLST form: Physician Orders for Life-Sustaining Treatments. I made it clear to both sons that were I to be in what I concluded was an intolerable living situation, whether due to immobility, mental deterioration, or very severe pain – I'd simply do my best to voluntarily 'shut down'. Or, if I was still physically and mentally able to do so, I'd just walk away – into the ocean, into the wilderness – just disappear, depart, be gone. Those 'plans' are reflected in the final chapter of this Memoir.

Manzanita 2016 found me reading Arthur Koestler's *Janus: A Summing Up*, which I greatly 'enjoyed'. I was especially impressed by his perceptions of mankind's 'paranoid streak'. He discusses 'what went wrong with our species': why 'have we made such a bloody mess of history?', concluding that we are an 'aberrant ... species'. He suggests that 'homo sapiens is one of evolution's countless mistakes.' He suggests a 'treatment' for the pathology he's diagnosed



in Janus' Chapter 5: An Alternative to Despair: We need to be 'immunized against the hypnotic effects of propaganda and thought control...'; he suggests that it can only be done by 'tampering with human nature itself... concoct elixir vitae... [the] transformation of *homo maniacus* into *homo sapiens*...'

I was impressed and pleased, because that's basically what I and the 'harmless' team had attempted in *State Change*, which 'appeared' just a few months before I read Janus. Interesting.

I then read (finally) his classic *Darkness at Noon* (1940) in late 2017 in Pacific Grove, CA. Koestler was well aware of Aldous Huxley's *The Doors of Perception* (1954), but perhaps not of Huxley's *Island*, published just a year before Huxley died in 1963. Koestler said a few critical words about chemical manipulation before his death. Huxley did say, however,

"...it is fundamentally wrong, and naïve, to expect that drugs can present the mind with gratis gifts – put into it something which is not already there. Neither mystic insights, nor philosophic wisdom, nor creative power can be provided by pill or injection. The psychopharmacist cannot add to the faculties of the brain – but he can, at best, eliminate obstructions and blockages which impede their proper use. He cannot aggrandise us – but he can, within limits, normalise us; he cannot put additional circuits into the brain, but he can, again within limits, improve the coordination between existing ones, attenuate conflicts, prevent the blowing of fuses, and ensure a steady power supply. That is all the help we can ask for – but if we were able to obtain it, the benefits to mankind would be incalculable."

Huxley and others have called it The Mind at Large – And that is what the most recent MDMA/Psilocybin studies are also saying: '...eliminate obstructions and blockages...'. Interesting.

## Leonardo da Vinci

Leonardo became a driving interest and passion back in 1993, thumbing through Bob Olpin's copy of Shlain's *Art and Physics*. I had, of course, heard of Leonardo and his Mona Lisa – and his interests in Flight. The more I read and

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studied about him, the more interested I became – and the more committed and active I became in developing and building The Leonardo.

One of the very best video documentaries on Leonardo was the BBC's now classic *The Life and Times of Leonardo da Vinci*. The series begins with Leo on his death bed in Amboise, France. His patron, the King, arrives for a brief visit, having heard Leonardo was ill. Leo, now 65 years old and dying, is apologetic and says:

“Tell me, did anything get done?... So much undone...”

Carl Sagan died in December, 1996, at the age of 62 – after fighting myelodysplasia for two years. His thoughts on death and dying – and legacy – are at the end of his last book, *Billions and Billions: Thoughts on Life and Death on the Brink of the Millenium*, published posthumously via Ann Druyan in 1997. His legacy is immense and has been noted in several sections of this memoir.

*Billions and Billions* includes a chapter called ‘The World that Came in the Mail’. In the 90s hollow glass spheres known as Biospheres and Closed Ecological Systems (CES) were purchasable, although delicate and fragile. The spheres were sealed, closed off from all exchange of matter with the surrounding world. They were transparent but otherwise closed and impermeable. He recalled watching the small visible creatures and musing on the significance of balance in nature and ecology – of the origins and stability of life.

Carl's words:

“Somewhere, something incredible is waiting to be known.”

And on Death: “Look Death in the eye and be grateful every day for the brief but magnificent opportunity that life provides.”

His final interview 5-27-1996 with Charlie Rose:

“We've arranged a society on science and technology in which nobody understands anything about science and technology, and this combustible mixture of ignorance and power sooner or later is going to blow up in our faces. I mean, who is running the science and technology in a democracy if the people don't know anything about it...”

He pleaded:

“Anything else you're interested in is not going to happen if you can't breathe the air and drink the water. Don't sit this one out. Do something.”

## Rachel Carson and *Silent Spring*

Rachel Carson was a shy, reserved writer who was not interested in public exposure or the limelight. She became known as a good popular science author for her two small books *The Sea Around Us* in 1951 and *The Edge of the Sea* in 1955. She considered herself a poet of the sea (via Jill Lepore of *The New Yorker*). She began working on what would become *Silent Spring* in the late 50s, finishing and publishing the seminal book in late 1962. She was suffering from recurrent bouts of cancer during the final writing.

She'd been concerned about mankind's assault on the natural environment since 1945 – the year of Hiroshima and of the first use of DDT. She wanted to write about it:

“...knowing what I do, there would be no future peace for me if I kept silent,” she said.

She began studying, planning, and writing in late 1958 what eventually became *Silent Spring*. She was afraid ‘that she herself might be silenced’ (via Jill Lepore) – that the cancer would get her before she finished. She was very ill through most of 1961. Jill Lepore wrote:

‘She was afraid of dying, but she was terrified of dying before she could finish the book.’

She did finish and it was first published in serialized form in *The New Yorker* in mid-1962. The book appeared just shortly after – some four years after she began the project.

She countered and fought the intense criticism she received from the chemical industry, testified in Washington, D.C. and fought the cancer taking her life, dying in April 1964 – she was 56 years old. Her last public speech was called ‘Man Against Himself’.

*Silent Spring* informed the world as to the dangers of overuse of toxic chemicals, particularly herbicides and pesticides, fueling concerns on environmental pollution and leading to the establishment of the US EPA (Environmental Protection Agency). Her editor, Paul Brooks, in his Foreword to the 1987 printing, wrote:

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‘She succeeded in making a book about death a celebration of life.’

She was a remarkably gifted writer.

From Jill Lepore, again:

‘Before Carson got sick, and even after, when she still believed she might get better, she thought that she’d take up, for her next book, a subject that fascinated her. “We live in an age of rising seas,” she wrote. “In our own lifetime we are witnessing a startling alteration of climate.” She died before she could begin, wondering, till the end, about the swelling of the seas.’

*Silent Spring* at 50 was a UU Stegner Center conference in early March, 2012. The meeting reinforced my interest in Carson and her remarkable book. At the meeting I purchased a 2005 book by P. Coit Murphy, one of the speakers, titled: *What A Book Can Do: The Publication and Reception of Silent Spring*. Perhaps that had some impact on my wanting to write a significant book. <https://www.swarthmore.edu/news-events/priscilla-coit-murphy-67-life-and-afterlife-a-book>

Her legacy continues...

## Aldous Huxley and *Island*

Aldous Huxley played a very major role in *State Change*. It began with his personal mescaline experiments, leading to *The Doors of Perception*, and ended with his successful, difficult effort to finish his final book, the novel *Island*, 1962. He was suffering from esophageal cancer, dying in 1963 – on the same day John F Kennedy was assassinated – and while Rachel Carson was herself being overcome by her cancer.

Huxley was famous for *Brave New World*, 1932, and for other novels and essays. He was a screenwriter in the 40s. 26 years later in *Brave New World Revisited*, in 1958, he advised on how Mankind might minimize its own ‘paranoid streak’ (to quote Koestler) in *Revisited*’s final chapter. That was developed in *Island* – his approach to a pseudo-utopia, in contrast to the dystopia of the much earlier *Brave New World*.

Huxley had deeply felt apprehensions about the future the developed world might make for itself. From these, he made some warnings in his writings and talks.

In a 1958 televised interview conducted by journalist Mike Wallace, Huxley outlined several major concerns: the difficulties and dangers of world overpopulation; the tendency towards distinctly hierarchical social organisation; the crucial importance of evaluating the use of technology in mass societies susceptible to persuasion; the tendency to promote modern politicians to a naive public as well-marketed commodities.

<https://ghostarchive.org/varchive/1EPNGa0M3XA>

Months before his death, he'd written to a journalist:

"... I have known that sense... of the world's fundamental All-Rightness, in spite of pain, death, and bereavement..."

Laura Huxley:

"November 22, 1963, was to be the last day on earth for two men of goodwill... John F Kennedy and Aldous Huxley had waged a common fight against ignorance and bad will; both dedicated their lives to helping humanity to understand and love itself."

Albert Hofmann, the discoverer of LSD in the early 50s, said:

"Huxley saw the value of hallucinogenic drugs in that they give people who lack the gift of spontaneous visionary perception, belonging to mystics, saints, and great artists, the potential to experience this extraordinary state of consciousness, and thereby to attain insight into the spiritual world of these great creators. Hallucinogens could lead to a deepened understanding..."

...He believed in the great importance of agents producing visionary experience in the modern phase of human evolution....to achieve a new culture in which rationalism and mysticism are fruitfully united...

[He wanted] the development of a real Natural History of visionary experience....A human race with more highly developed spiritual capacities, with expanded consciousness of the depth and the incomprehensible wonder of being, would also have greater understanding of and better consideration for the biological and material foundations of life on this earth....the development and expansion of a direct, emotional experience of reality, unobstructed by words and concepts, would be of evolutionary significance. [He] considered psychedelic drugs to be one means to achieve education in this direction."

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Huxley's wife, Laura, comforted him during his final hours. He had prepared and planned for his own passing. He asked her to inject him with a light dose of LSD, to aid his passing. She did, and he went quietly. She suggests, at the end of her 1968 memoir *A Timeless Moment*, that this may have been related to his interest in making the world aware of the potential and promise of psychedelics – his final gesture to increase public awareness of what he called one of the three greatest discoveries of mankind. She concludes:

“Aren't we all nobly born and entitled to nobly dying?”

Huxley wrote *Island* during 1960–61, it was published in 1962; he died in 1963.

It's very interesting that Rachel Carson focused on biocides – chemicals of death – whereas Aldous Huxley concluded that psychedelics were chemicals of life – of openness, transparency, beauty.

*Richard Feynman*, another of my unmet heroes, died in early 1988 at the age of 69. He had battled liposarcoma, a rare cancer, for several years. Always thinking, always scanning, always curious, his final words were:

“Dying sure is boring.”

“I can live with doubt and uncertainty and not knowing. I think it is much more interesting to live not knowing than to have answers that might be wrong. If we will only allow that, as we progress, we remain unsure, we will leave opportunities for alternatives. We will not become enthusiastic for the fact, the knowledge, the absolute truth of the day, but remain always uncertain ... In order to make progress, one must leave the door to the unknown ajar.”

He also said something about legacy:

“I guess there is a kind of afterlife. The few bits and pieces that we do might get remembered.”

He didn't need a 'Legacy' website!

## David Suzuki

David Suzuki published *The Legacy* in 2010; he was then 74 years old. Sometimes called Canada's Carl Sagan, David has spent a lifetime trying to

make people aware of the need for planetary sustainability. We never met. He's been called *a force of nature*, the title of a documentary film on his career and life.

In 1992 his then 12 year old daughter spoke at the Earth Summit Conference in Rio de Janeiro:

“The pursuit of endless growth is suicidal....

I am what I do, not what I say.”

The First international Earth Summit's secretary-general, Maurice Strong, said: ‘No place on the planet could remain an island of affluence in a sea of misery. We are either going to save the whole world or no one will be saved.’

That was before us president George H W Bush, on leaving the summit, said:

‘The American way of life is not up for negotiation. Period.’

And it's been that way ever sense. We – the USA – expect all others to behave responsibly, while we continue our gluttonous, destructive consumerism and excess consumption.

David's Japanese background and experience with the indigenous communities of western Canada (the First Nations) has imprinted upon him the recognition of and importance of ‘elders... the wisdom keepers.’ He shares that wisdom via books, TV programs, and a special legacy film.

On the first page of *The Legacy* he writes:

‘I'm in my 70s ...in the last part of my life. I call it the Death Zone ... each day is a gift to be celebrated.’

## Christopher Hitchens

Christopher Hitchens was a very different individual. He was considered one of the Four Horsemen who argued against religion. I was very stimulated by his *God is Not Great: How Religion Poisons Everything*, 2007. The other three Horsemen, who published books at about the same time challenging organized religion, are Richard Dawkins, Sam Harris, and Daniel Dennett. Hitchens wrote *Mortality*, 2012, as he was dying (‘this year of living dyingly’, he wrote)

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from the esophageal cancer that killed him in December, 2011. He was 62 years old.

The Foreword to *Mortality*, by his editor Graydon Carter says; ‘there was something in his saucy fearlessness, in his great turbine of a mind, and in his sociable but unpredictable brand of anarchy that seriously touched us all.’

I never met Christopher Hitchens, but I ‘know’ him via his books and essays, including *Arguably*, 2011, and his memoir, *Hitch-22*, 2010.

One of Hitch’s favorite quotes was by Horace Mann:

‘Until you have done something for humanity, you should be ashamed to die.’

He also quotes Leonard Cohen’s ‘If It Be Your Will’ lyrics on death, as well as Bob Dylan’s ‘he not busy being born is busy dying’.

## John Kerry

*John Kerry’s* memoir, *Every Day is Extra*, 2018, has also been an inspiration.

Part of my interest in John Kerry was in a speech given by his wife Teresa, during the Democratic Convention of 2004, when he was nominated as candidate for President. John and Teresa met at the Rio Earth Summit Conference of 1992, and discovered they had common interests in preserving Planet Earth. Teresa, of Portuguese-Mozambique extraction, said in her 2004 speech:

“My name is Teresa Heinz Kerry – and by now I hope it will come as no surprise that I have something to say.”

And she did. <https://www.youtube.com/watch?v=5ebso59dhZg>:

“There is a value in taking a stand, whether or not anybody is noticing it, and whether or not it is a risky thing to do...

freedom is a sacred gift sanctified by those who are living it and those who have died defending it...

It is time for the world to hear women’s voices – in full and at last...

Referring to John Kerry, she continued:

...the face of a Peace Corps Volunteer...



alternative energy... protecting the air we breathe, the water we drink, and the health of our children... good environmental policy...

In America, the true patriots are those who speak truth to power.....a moral nation...

I think I've found that guy...

From John Kerry's own memoir, *Every Day is Extra*:

"...the worst thing of all would be to waste the gift of an extra day by sitting on the sidelines indifferent to a problem..."

We just can't sit on our asses and leave the political process to neanderthals who don't want to believe in the future."

Yes. Onward...



# Slow Physics and Slower Thinking

*Prologue • An Artificial Hip • Slow Physics • Slow Thinking • Adios, Bob  
Sweeney • Happy 75th, Barb! • Welcome to Madeira • My Last Big Talk •  
More in 2017 • A Solar Eclipse • And Back to California*

## Prologue

**A**GING OCCURS BOTH continuously and in stages, punctuated by key events, especially accidents and trauma. For most of my first 50 years, I loved to walk fast, often hunched over with a heavy backpack. Bad posture, but speedy. Students and colleagues would have trouble keeping up. I became annoyed at people who walked slowly, or – worst – sauntered lazily, especially in crosswalks. I had been taught to not dawdle, to move, to make full ‘use’ of time.

Working on The Leonardo project, I designed a set of activities on MDD: Motion Deficit Disorder.

It had to do with metabolism, obesity, and exercise. Americans, I felt then and now, have become slow and lazy – dawdling, sauntering, generally oblivious of the world around them.

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I recall two rotund nurses at the UU Hospital, as I was rushing to an appointment, standing in front of two large doors to the corridor I was entering. They were waiting for the doors to automatically open for them. As I ran ahead and pushed a door open, I could hear one say:

‘Oh, you have to push these doors open!’

That summarized the present social conditioning we live in. We have self-opening doors, sensors everywhere to aid us in behaving safely, and ‘labor’-saving devices everywhere. We’ve forgotten how to rake leaves or shovel snow, how to climb stairs – up or down, how to open doors. I would learn later that these ‘advances’ are good for those with physical handicaps, but ‘bad’ for the rest of society who now suffer from MDD.

## An Artificial Hip

My first real experience with diminishing physical capacity began in the early 90s, when I was on the very top of a 10 foot ladder working to top a large elm tree cluster in the backyard. Tonio was helping me. I fell, landing inverted on my back in the ground-level crotch of the tree. The pruning shears were next to me, mouth end straight up. I barely missed them. I slowly extricated my bruised body from the confines of the tree, rubbed my back and legs, and limped off to recuperate. Although shaken, I was apparently fine, though recognizing that if I hadn’t missed those shears...

We had a one acre backyard that required pruning, furrowing, irrigating, and mowing. I usually enjoyed the work. Barb and the boys did much of the work, although the fall happened after the kids had left home for college. Tonio must have been home for the summer when I fell. I recall scything the tall grass in the back (before, but also in lieu of, weed whackers!), swinging and rocking side to side to rapidly and cleanly slice through the grass.

It was perhaps two years later that I began to have right hip issues – an occasional limp and occasional pain. I knew enough about orthopedics and cartilage to suspect that the right hip’s cartilage was damaged.

By early 1996 I had mild lower back pain and fairly severe hip pain. I had trouble sitting for more than short periods, my legs had to be extended even while sitting, I was always restless in a chair. So I went to the doctor. Yes, there was 'early' degenerative joint disease, and early evidence of lower back disc issues. I took a lot of aspirin, walked with a cane, and generally tried to 'grin and bear it' – to just live with it. I was in my mid-50s, too young for an artificial hip.

So that was the first stage in my appreciation of the need for Slow Physics. Motion is all about stability and balance, velocity and acceleration, and position and posture – classical Newtonian Physics.

I'd always had crappy posture, obvious in early family home movies of Boy Scout hikes – bent over walking rapidly with a heavy pack. I'd always walked rapidly, but almost never fully vertical. But I was always too 'busy' to correct the problem.

In time the limps and pain worsened. I became very dependent on the cane, walking more slowly. Although aspirin worked, we were concerned about its blood and stomach side effects. Meloxicam was a non-aspirin pain drug not yet available in the USA, used to treat arthritis. It reduced pain, swelling, and stiffness of the joints. It was one of the first nonsteroidal anti-inflammatory drugs (NSAID). I learned of it from European colleagues. It was readily available in Germany, Netherlands, France. Tonio brought me some when he'd return from studying in Spain and The Netherlands. When in Germany, Frederick Kopp help me obtain some. Eventually related drugs became available in the U.S. – Celebrex and Vioxx – COX-2 selective nonsteroidal anti-inflammatory drugs (NSAID). They helped.

Several years later I realized and accepted that the pain, aspirin, Meloxicam, Vioxx couldn't continue – that if I wanted to be functional and tolerable, I'd need surgery. Fortunately, in the early 70s Bob King and I had worked with Harold Dunn on an artificial tendon prosthesis. Hal Dunn was a somewhat young orthopedic surgeon who had been working with Larry de Vries in Mechanical Engineering. He agreed to look at my hip. He advised me to wait as long as I could tolerate the discomfort. But, several years later, we concluded, that although I was still relatively young, an artificial hip was the most effective solution to my growing dysfunction. It took us a year or longer to fully agree, commit, and schedule. I wanted to put it off as long as possible, but I also knew that I didn't want to compromise my very essential liver with anti-pain drugs.

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Barb and I moved off our little acre and into 949 Millcreek Way in late 1997. Vlado and I worked hard to remove the ugly dark rug and especially all the staples holding it to the hardwood floor. Hard work. Because I was on high dose aspirin, my knees would bruise and, even with gloves, my fingertips would bleed. I even peed very light pink several times. That was frightening. So I called Dr. Dunn. We talked, scheduled, did surgery, and did post-op.

Orthopedic materials can produce wear and inflammation, and even implant-associated infection. So I was very cautious. I knew that all orthopedic biomaterials degrade or corrode, even titanium – and that they also generate wear particles in the joint itself, which migrate out into the capsule and local tissues. I wanted to minimize wear by decreasing the applied load via a cane.

I also wanted to monitor corrosion via blood and/or hair analysis of trace metals. We had done a baseline set of blood metal levels before surgery, and maybe once or twice after. I kept samples of my hair for the next ten years or so with a hazy plan to measure them via ICP MS some time later. It could be a cool exhibit for The Leonardo's planned exhibits on YOU!. We were to have a section called YOUR Personal Periodic Table. I still have the samples, although I stopped collecting them a decade or so ago. There has been no analysis.

Whenever walking long distances, and especially hiking, I'd use a cane. I'd learned the biomechanics of using a cane via a qualifying exam question I gave to the BioE graduate students earlier that year. After reading their responses, I was well versed in the biomechanics of canes and their use. Many months later, I used the cane mainly for long, vertical, strenuous hikes, especially Mt. Olympus – which continued through my 76th birthday.

Although using a cane on my left arm helps relieve the load on the right hip, and having a third 'appendage' helps with balance and security on the trail, it also requires one to slow down and be biomechanically cautious. It was cane use – pre- and post- artificial hip – that introduced me to Slow Physics. In the next two decades I learned about balance, response time, and general slowdown in perception. That was likely normal for people in their 60s and 70s. Plus I knew that falls became more common and more dangerous as one got older.

A year before my new hip, Pierre Galletti – a mentor and role model – died from falling down a friend's stairs while reaching for his coat in what he assumed was a dark closet. I tried to be careful and cautious by becoming an adherent of slow physics.

## Slow Physics

Slow Physics means:

never moving too fast to recover from a discontinuity or rough spot or crack in the pavement;

never moving so fast upon being startled as to throw yourself off balance;

minimizing any action or movement which might compromise your balance.

The main idea is never fall. But if you must fall, do it slowly enough so as to result in very minimal damage.

In the old days, when learning to drive, we were told never drive beyond your headlights – never drive faster/further than what you can clearly see. Once you hit your 70s, such advice applies to all aspects of your life.

But until then, we continued to go hiking, cross-country skiing, and exploring the wonderful lands and canyons of Utah. I continued to hike vigorously, including Mt. Olympus roughly once a year, around birthday time. Barb and I were both concerned and cautious about having to walk on icy paths and roads. We each had slip-on traction cleats for our shoes. We would occasionally use snowshoes when the conditions didn't permit safe cross-country skiing.

Barb had always been into yoga and physical exercise. We were generally quite healthy and enjoying our 'middle years'. We enjoyed our 'new' creekside abode, totally changing and improving its landscaping and making major renovation enhancements.

Dunn and I revisited the new hip regularly for the first few years, then every five years or so after that. I was of course concerned with wear and particles as well as the continued health of my normal left hip.

I was used to mild lower back pain, even before the artificial hip surgery. It had not been a serious concern until my early 70s. The back (and many other muscles) hurt after long hikes, and especially after Mt Olympus treks. The last several Olympus hikes, in my mid-70s, were very hard. I walked with two canes several times, especially for the downhill parts of the hikes.

Our winter 'escapes' in the Monterey area allowed us to walk extensively in the winter, due to the mild California weather. As we spent more and more winter time on the Coast, Utah skiing and snowshoeing receded. We still had to be careful with Utah cold, snow, and ice – especially in Feb.-April. We just

learned to be especially careful and cautious. And, due to Barb's oxygenation constraints due to the COPD, we were more energetic and comfortable at lower altitudes.

## Slow Thinking

It was in front of my garage workbench, in my mid-70s, that I began to recognize the 'Two by Six Syndrome' – TSS. I had a nice piece of 'scrap' redwood – two inches by six inches by about four feet. I was planning to use it for something, so propped it up against the bench, more or less in front of the Prius. Several days later, having done nothing in the garage for several days, I went to fetch the piece of redwood. Not there. I looked nearly everywhere. I asked Barb if she'd moved it. I looked for it where it had been stored before. Nothing.

It had disappeared. A few hours later I looked again, and nearly tripped over the vertical leaning plank of wood. There it was! It had been there all the time, of course. There were no ghosts on the premises. I didn't attribute it then to brain micro-clots. I was more optimistic. I defined the new syndrome to Barb as 'The 2x6 Problem'. She understood it less then than she does now. I understand it, too. The 'treatment' for TSS is humor and resilience – and faith in physics, especially Conservation of Matter.

So Slow Physics was just one half of our new lifestyle – one half of the equation. We also had to contend with Slow Thinking. I knew, as did Barb although she doesn't like to discuss it, that mental processes begin to slow down and become somewhat compromised as we move into old age – our 70s and beyond. Some studies show that nerve conduction velocity decreases as we get older. Response times increase, etc.

I liked to always be scanning, and experimenting – trying to sense my response times, acuity, contrast. I realized that many mental functions had been slowing somewhat. That meant even more cautious driving, for example. I had struggles with night driving, in part due to low grade cataracts. That was fixed in my 72nd year with cataract surgery, via two new intraocular lenses – thanks to Nick Mamalis in the UTU Moran Eye Center. They fixed the light scattering



and consequent glare – and some of the contrast concerns. They did not affect aged response times, however.

Lower back pain continued to be of concern, especially after daily walking of 5 miles or more.

In winter 2017–2018 we had been doing a lot of walking. Towards the end of our Pacific Grove stay, my lower back ‘went out!’ (next chapter).

It went out ‘irreversibly’, meaning that exercise and physical therapy could not correct the pathology. It required surgery and a major change in lifestyle. It also resulted in serious balance, and thus potential falling, issues. So, I went from Slow Physics via my artificial hip to Very Slow Physics some 20 years later due to lower spine fusion. It meant tolerating pain. It meant close matching of exercise and endurance against pain perception and the new musculo-skeletal constraints. It meant walking 3 to 5 miles per day, even if that means walking or jogging around and within the house.

The balance hesitations, and the need to protect the lower back from twists and excess stress, required even more care and vigilance – the realm of VERY Slow Physics; again, details in next chapter.

Fortunately I’d always been afflicted with a sort of ‘restless leg syndrome’ (RLS). I needed to move, twitch, stretch, stand up and walk about, regularly, almost constantly. Without RLS I might have ended up as a real couch potato.

Barb and I had often played *mini-PingPong* on a half-size foldup table. In our mid-70s we had it set up nearly all the time. We would play for 10 minutes or so several times during the day. The main exercise was (and is) chasing and retrieving the missed balls; the actual paddle work was good for upper body agility and tone. In 2018 we finally ‘discovered’ that the folded ping-pong table fit perfectly in the back of our Prius, so we could take it along on our trips to Monterey and Portland. Fortunately, we’ve become fairly good, are evenly matched, and both enjoy ping-pong. We recommend it.

Skin changes as you age, especially from about 70 on. It discolors via local bruising easily. It takes longer and longer as you age for that internal bruising to subside. I had experienced the effect earlier via my mother, Erma. In her 80s she experienced a lot of bruising and skin lacerations. The skin feels almost like a dry, flaky, croissant. It ruptures and tears easily – and bleeds of course. It has to be very carefully cared for, and it heals very slowly. So now, in my late

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70s and early 80s, it was my turn for flaky, bruiseable, slow healing skin. We accommodated.

Hearing also changes as you age. Barb and I noticed that I had some hearing – and perhaps sound perception – loss probably already in my early 70s. I had an audiology workup at *uu* Audiology Clinic about that time. The high frequency loss was deemed ‘moderate’, especially in my right ear. I vowed to myself, and Barb, to listen more intently. We accommodated. We knew friends with hearing aids: Henry Kopecek, Shahpar Ghodsi, then Antonia – and a little later – Paul Manda.

Finally, just before COVID-19 hit, Barb and I were getting increasingly frustrated – my every third or fourth word became ‘What?!’ I tried to train her to speak more loudly, more clearly, and with perhaps an extra adjective or two – to help my aging brain more effectively process the message. She tried. I tried to be more attentive, to concentrate more effectively. But the ‘What’s’ kept coming. So in May, 2019 I went to Costco, had a hearing exam, chose a pair of ReSound blue tooth replaceable battery hearing aids, and spent \$2500. They certainly improved the sound level I could hear. But they resulted in severe itching – and didn’t seem to help with understanding – with ‘translating’ what I was hearing. I could hear, but couldn’t process the sound. I was told by many:

‘Give it time. Wear them, continuously.

Your brain has to retrain itself – to adapt to your new sound environment’.

Well, they itched, they were uncomfortable, they didn’t seem to really help, the batteries were really small – and didn’t last very long, the switches on the aids were cumbersome to use; fortunately I could adjust them via their blue tooth capabilities, although that, too, took time and patience. I returned to Costco several times for cleaning and refitting. I wore them semi-sporadically for the rest of the year. And then, in early 2020, COVID hit, lockdown occurred, masking happened, and suddenly hearing aids became even more cumbersome – and seemed largely unnecessary.

So I played hearing aid ‘hookey’ for the next two years – frustrating Barb’s life – and my own – with incessant ‘Whats?’. Paul Manda educated me a bit on hearing aid and ear canal hygiene, which helped some with the itching. I did another *uu* Audiology workup in fall, 2022, with results similar to what was measured at Costco in early 2019. Costco repaired my slightly damaged devices, I became more adept at working with the tiny batteries, and I began

to wear them at home and in groups when I wanted to hear and communicate. I now normally do not wear them when I'm hiding and writing, or on the bus (where I usually mask). I am trying to wear them at all other awake times. I can hear with them; I still have issues with understanding what I'm clearly hearing. That's part of my Slow Thinking Syndrome (STS) in this now 82nd year! We keep accommodating!

## Adios, Bob Sweeney

Bob died in August, 2016. We last saw him a year earlier at the Rabanal's 50th anniversary celebration in Evergreen, Colorado. He was showing signs of slowing and perhaps some dementia. Karen confided that he did have some mental deterioration. It was only later that she, and we, learned that his undiagnosed condition was due to Lewis Bodies, the same disease that drove actor and comedian Robin Williams to his death. Barb and I drove to Boulder, CO to participate in Bob Sweeney's Celebration of Life event on Oct. 8, 2016 on the CU campus. We shared some stories with Karen, Allison, Craig, and Meghan of our 50 years of friendship.

Barb and I then routed to Grand Junction, via Vail, to be with the Rabanals. We visited the Betty Ford Garden in Vail, got some ideas for our own garden, and bought a little girl-size tree saw for Barb. Both Karen and Becky had recommended the garden to us.

In late November we were off again to the Pacific, via the Arsalans in LA, Cambria, and then Pacific Grove. Karen was also there for several days in December, giving us the opportunity to remember Bob as well. Then we drove Mr. Prius up the coast to Petaluma again, then 101 up to Yachats, and on into Portland, where we bedded down our loyal Prius for the next very cold and snowy (in Portland!) month. We then left the country for three weeks!

## Happy 75th, Barb!

The lovely and rugged Portuguese island of Madeira beckoned. Barb and I wanted to do something very special for her big 75th. Erma, with her sister Mary, visited Madeira in 1987 and talked glowingly of her experience. Barb and I had a good experience with the kids in the Azores in July, 2000. Barb saw a travel story on Madeira in the *Times*, noting that it had a year round climate like Monterey – even better. That sounded comfortable for us. We knew Madeira’s almost perfect year round climate was easily accessible via Lisbon or London. So we did some homework, rented a VRBO-listed small apartment in old town Funchal (from a Carmo Andrade – no relation!). It was near the harbor and the major island bus terminal. We made reservations from London via cheap EasyJet Air. We wanted to travel cheap and light. I bought a new 2 pound MacBook as our cheap Copenhagen Air flight (from Los Angeles) had a 20 pound carry on limit. We were prepared.

As we talked with our friends about this exciting trip, Fanny suddenly glowed even brighter, saying:

“I’m coming, OK?”

“Uhh, well, sure!” Barb replied.

“And that’s the same time as my sister Jennie’s birthday – maybe she’ll come, too!”

“Uhh, well, OK,” we said.

Then friend Tessa Epstein, one of the honorary Latinas in Amigas e Libros, hears about our plans:

“Can I come, too?”

“Uuh, well, why not?”

And practically within hours of learning of our plans, Fanny and Tessa were booking flights and scouring VRBO for a place to stay.

Tessa, originally from England, has friends and family there so she routed via London. Fanny, Jennie, and Tessa also had a former Amiga via Libros in Barcelona, so they made plans to route home via Spain.

In early January, 2017, three weeks before Barb’s Jan. 25 75th birthday we parked Mr. Prius in the Manda’s driveway in SE Portland, boarded a flight to LA, waited around and then boarded a Copenhagen Air flight to London’s Gatwick

airport. We stayed at the airport hotel, which I'd been pleased with during my s&n consulting days. We prepared for Madeira, slept, woke early, and made our way to the EasyJet Gate. We went and went – walked and walked. We had no idea how far it was. I should have checked earlier – too late now. We began to run. On and on – finally reaching the just closed gate. Too late by just minutes! That was it. No excuses. No exceptions. No refunds.

Fortunately we were directed to a nearby British Air agent and booked a flight to Lisbon and on to Funchal for that mid-afternoon. We tried to reach Carmo in Madeira to no avail. We made it to Lisbon, flying in over the Tagus and the beautiful Portuguese countryside. Then we boarded our flight to Funchal, and took off. Leaving Lisbon, perhaps 20 minutes out over the Atlantic, the plane turned around – and landed back in Lisbon! – some mechanical difficulty. We stayed on board. A half hour later we were rolling down the runway again, finally landing in Funchal after dark. Thanks to a resourceful cab driver, we reached Carmo, and headed for our oldtown apartment. Mr. and Mrs. Carmo Andrade met us there. We vociferously apologized as they had clearly been very concerned.

## Welcome to Madeira

It was a great place. We looked out over a small plaza, a very old small church practically next door, a small walking street full of outdoor wall-to-wall restaurants, the harbor just a few minutes away. We could walk almost everywhere. Ideal for us.

Antonia sent us a picture of Mr. Prius, covered with three inches of wet Portland snow. We were walking in 70 F shirtsleeves!

Barb used her Portu-Spanish, I used my little Joey pre-primary school Portuguese, and we began to explore. We learned how to change money, looked into the bus routes, found a huge local farmers market, explored restaurants – and just walked. Some days later, Fanny, her sister Jennie, and Tessa arrived. They had booked a place a 10 minute or so walk from ours. Barb was in touch with them via WhatsApp. We were dining at a small restaurant up the hill from

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our apartment. We were enjoying the food, when Fanny came in the door, followed by Jennie and Tessa! Surprise. The place was full, but the kind waiters made a place outside for the Four Amigas and me. A great beginning to our Madeira adventure.

We took the cable car to the park and Monte Palace overlooking Funchal, explored the beautiful Historia de Portugal in mosaic tiles there, visited the Botanical Garden, rode buses, explored cafes, and enjoyed restaurants.

A highlight – and primary reason we chose Madeira – was the island’s numerous levadas. They are small irrigation channels which gently weave down the mountain slopes bringing water from the wetter north side to the drier south side of the island. When installed hundreds of years ago, these channels included a small trail alongside, to facilitate inspection and repairs. Those little ‘repair’ trails now form much of the network of not steep hiking trails which pervade the south side of Madeira. We also booked a ‘tour’ to the nw corner, to the town of Porto Moniz.

Fanny discovered a coastal easy path from downtown towards nw Funchal. We rode the bus further west to visit an incredible cliff overlook at Cabo Girao.

There were several trails near Funchal which had English style teahouses adjacent to the trail (Jasmine Teahouse and Hortensia Teahouse). They served light meals, had beautiful views, and served the hiker community. I am especially fond of a quote on the Jasmine Teahouse menu:

“Would you like an adventure now, or shall we have our tea first?” –Peter Pan, in Jasmine Tea House, Funchal, Levada dos Tornos

The Fanny team stayed for only five or so days, then went off to Spain. Some days later Barb and I celebrated her 75th birthday at the same nearby restaurant where we’d dined earlier with the Amigas. During our quiet dinner it became known that it was Barb’s birthday. The waiter wanted to help us celebrate. At the end of our meal he brought out a small cake with a candle and the word *Parabens* inscribed with frosting – meaning Happy Birthday, as well as Congratulations, and Best Wishes. I think we had ordered *maracuja* ice cream for dessert.

We’d discovered *maracuja* (passion fruit) ice cream from a cone vendor in downtown Funchal – and loved it. It became our special Madeira treat, together with a strong local drink called *Poncha*. The drink we discovered first with Fanny! Poncha is the traditional alcoholic drink for Madeira. It’s made fresh

with citrus juice, honey and aguardente or rum. The drink is strong and thought to cure the common cold. We liked it – and so did the Amigas.

Barb and I took basic Portuguese lessons for two weeks at a local private school. A Patrizia Rubina was our teacher. We also discussed Madeira's economic and political issues and Russian investment and likely money laundering. We intended to keep studying after Madeira – but we didn't.

We left Madeira directly to London on our original SleazyJet reservation. But they wouldn't allow my backpack as a legitimate carry on together with a small suitcase (one item only). So we paid the \$60 or so bag fee and finally boarded. Later on we learned that Tonio and Andrea had the same problem a year or so earlier with EasyJet. It was really my fault – and that of the almost hidden fine print. So back to London Gatwick, the same hotel, and the next day direct to LA via Copenhagen Air. Then an hour or two in LA to catch a late flight to Portland – via Sacramento – on Southwest Air. We were younger then! A great trip. We reconnected with our abandoned Prius, and a day or so later drove East through the Columbia River Gorge, just ahead of an incoming storm. We probably routed direct to Salt Lake City via Boise.

## My Last Big Talk

On April 1, I gave a keynote talk at a major national bioengineering meeting in Salt Lake City:

Empowering Reality, Rationality, Creativity, Empathy – Scientists and Engineers: Facts, Truth, Democracy?

The press release I issued said:

Biological Engineers Urged to confront Ignorance, BS, and Lies

Biological engineers are being urged to combat ignorance, BS, and outright lies at their annual meeting this week in Salt Lake City. The 17th annual conference is at the downtown Marriott Hotel and Salt Palace Convention Center Thursday through Saturday, April 1.

## Obrigado Pela Vida

One of the keynote speakers is Joseph Andrade, a University of Utah Distinguished Professor of Engineering, and a 2012 candidate for Utah's District 2 US Congress seat. He lost that election to Representative Chris Stewart.

Andrade, retired from biological engineering research and teaching, is now a novelist. He self-published and released *State Change* – a chemical and political fantasy last year, well before the 2016 elections.

“A group of aging activists selects well known political ideologues and subjects them to clandestine (and illegal) revelation engineering,” he explains, “including Utah’s Congressional delegation.” He smiles.

His keynote talk builds upon the novel and upon his earlier Congressional run – to empower biological engineers to get more involved in science education, in politics, and in running for public office. He suggests his colleagues use social media to confront ignorance, BS, and lies.

The talk is in Ballroom A, Salt Palace Convention Center, 11:15 am this Saturday, April 1. The talk will be available after the meeting at [www.statechange.us](http://www.statechange.us).

I don't recall any press action on the event, but there was a fair audience response via Q and A.

A month or so later the Bioengineering students at Utah State University invited me to present a similar talk at their regional meeting of the Institute for Biological Engineering (IBE) in Logan, Utah in November. I accepted, of course.

## More in 2017

The rest of the first week of April was Folly Beach with the granddaughters – and their parents.

In mid-April I was off to Oakland to attend Psychedelic Science – 2017, a major international meeting organized by MAPS. That's where I met MAPS' Rick Doblin and also Ann Shulgin – and gave each a printed copy of *State*



*Change.* After the conference I routed to Pacific Grove (PG) to continue our PG house hunting quest, staying in a motel towards the top of Lighthouse Ave. Our realtor, Toni Fleming, took me to visit a variety of listings over the two days. I found one almost adjacent to the Presidio in Monterey which looked good for us. We made a preliminary offer. Doing some additional homework after getting home, we realized it had some serious shortcomings – and rescinded the offer. Our semi-serious search continued.

In May Barb and I were treated to a visit by Tanzey and Roger Doyle, from Devon, England. They were on their way to Yellowstone in a rented RV. Tanzey had managed our Surface Analysis Lab in 1980 for a year or so. She then went on to a strong career in England in orthopedic biomaterials, later founding the journal *Clinical Materials*. It was a pleasure to learn of their gardens, goats, and life in southwest England.

Also in May I completed the vacating of my MEB UTU office. What I hadn't given away I transported to our garage, now housing only the Prius, so there was room for stuff.

Early June was get in shape time for Mt. Olympus, with several training hikes. I did the hike on June 15 – one month before Birthday #76. It was again grueling. Little did I know that was the last Mt. Olympus hike for me.

Mid-July we were back in Portland and Manzanita, via Boise, Bend, and Corvallis. Fanny was with us in Portland. She stayed with us in a small home near Westmoreland Park and near the Mandas. Fanny showed Barb and her sisters some special Mexican cooking. Then it was on to Manzanita. Josie and I explored the Public Library and Playground.

'Maybe I'll make a friend,' she said.

And she did, befriending a younger girl on the playground.

We spent a week or so at Susan's Cottage. That was the year and place where Amalia inherited her lightly used trumpet. We celebrated birthdays with the help of Amalia and Sylvia's pies. We routed back home along the coast via Waldport, where I learned of the path of the upcoming solar eclipse via a great T-shirt we bought in a Mexican cafe. We stayed in a delightful chalet just south of Bandon, then across to 1-5 to Myrtle Creek and Ashland. After a night in Ashland, we headed east, listening to Gerry Elias' audio book, *Devil's Trill*, and on to Lakeview, where we explored the new Lakeview Public Library. Then it was home via Denio Junction and Winnemucca.

## A Solar Eclipse

A few weeks later we journeyed north to see the solar eclipse in Victor, Idaho, as the guest of Jon Hibbs – and Ginger and Tess. John and Francoise Hibbs were also there. We had learned that my old San Jose State buddy, Dennis Olsen, would also be watching, with his daughter Shari, her husband Christian, and daughter Emily. We connected with them at a restaurant in Logan, Utah, where we first met Emily and Christian, and had a great discussion. They were also eclipse bound; we told them we'd be watching from Victor at the home of a friend. Then we parted ways.

We headed north towards Grand Teton Park, then skirted west and north to Victor and to the Hibbs' place. We had a great time with John, Jon, Ginger, Francoise, and of course mighty Tess, a real frontiers-woman – and only 6 years old! The eclipse was, of course, fantastic.

Thousands of others made the trek north on I-15 to view the event. We, fortunately, had routed via Logan and Jackson Hole, missing most of the eclipse-bound traffic. But, then...

after the event, instead of retracing our trip to the south, we drove to Idaho Falls to catch I-15 South, not realizing that was a dumb decision. We joined I-15 which was barely moving. We kept assuming it would start to clear. It didn't.

I-15 was basically a parking lot, just barely moving, for hours and hours. Towards nightfall we exited onto a gravel road in rural Idaho, decided to park on the side of the road as it was getting very dark, unpacked our Prius, put the back seats down, and tried to sleep. Every now and then a small truck or car would pass by us. Sleeping in a Prius is not comfortable. We couldn't toss or turn. I lay on my back trying to not snore. Not too difficult as I wasn't really sleeping. We could see the cars on I-15 in the distance, barely moving. We snatched what sleep we could over the next four or so hours, then packed up our stuff, and got on the road again. By now the traffic was moving again. I think we used Highway 91 for a time – it sort of parallels I-15. We stopped for breakfast, probably just north of Pocatello. By the time we made the Utah border, traffic was moving fairly well.

We learned later from friend Dennis that he and his team just routed back the way they came – via Logan, Utah – and encountered almost no traffic! But Barb and I proved to each other that we could indeed sleep a bit in the Prius – if we had to.

The eclipse experience convinced me that people can respond to a significant event. Thousands drove long distances to see a spectacular natural event – part of cosmic reality. It gave me hope that perhaps people can be mobilized to see, understand, care, act. Perhaps there's some hope for politics, for revelation, for sanity.

I was doing a lot of old photo scanning that summer and early fall. Perhaps a thousand or more photos, swelling our digital collection, even after regular purging, to some 15,000 photos!

## And Back to California

Around Thanksgiving we headed south, finally finding Parowan Gap off I-15. During an earlier trip with Mandas we couldn't find it! We visited several towns on the way to Los Angeles. There was a major southern California Latin Art exhibition going on at that time. Barb wanted to see it all! We started with the Orozco exhibit at Pomono College, staying in a small hotel near the College. We viewed some exhibit in Claremont. I wanted to see the Cal Tech campus in Pasadena again. We walked through its Throop garden, seeing rocks from the nearby San Gabriel Mountains representing two billion years of geologic history. Then it was on to LA and a French-themed hotel in downtown LA, the Normandie, where we stayed perhaps two nights. The huge public market was a few blocks away. We rode LA's relatively new light rail system – and buses – to see the Getty Museum, the LA County Museum of Art, the Hammer Museum, and had a sandwich in the adjacent UCLA Mathias Botanical Garden. We of course visited the LA Public Library, the central facility for the ongoing Latin Art exhibition. We were impressed by the quote over the main entrance:

'Books Invite All. They Constrain None.'

## Obrigado Pela Vida

Then it was off to North LA to see the Aarsalans in Woodland Hills. The whole team was there to greet us, including Nadia. Then up to Carpentaria, Cambria, Pedras Blancas for the elephant seals and on to PG, initially at the Townhouse rental on 7th Street.

Aaron and the Decatur Andrades joined us right after Christmas through New Years. We all stayed at the large Spanish-themed house near the top of Lighthouse Avenue; this one has a small, attached apartment, perfect for Aaron. The Blauers joined us for a few days, staying nearby. Fanny and the girls made masa tortillas. Aaron had brought his smaller keyboard – he and Tonio played and jammed, as did the girls... on in to 2018.

2017 – another very good year, via Slow Physics and Slower Thinking.

# Pain and Pandemic

2018 Begins... • Back Problem • Playing and Tripping with Pain • Adios, Paul Dryden • Before Surgery • Distractions • Lower Back Surgery • Pain, Addiction, Distractions • Manzanita – 2018 • Don Olsen... • Cuba – for Barb and Antonia • Back to Pacific Grove • House Hunting • Home Again • Chuck Bowden – John Hibbs – and Atlanta • Portland to Pacific Grove, via Bandon • Carmel Meadows, to SF, to SLC • Henry Kopecek's 80th, and SW Kim's Last • It's a Pandemic! • Pacific Grove – in July • From Tree to Stump • Pandemic Year 2 – Vaccines!! • Manzanita, Books, Yachats, and Echo Summit! • Vaccines and Jake Hanson • Socorro and Lucero • Late 2021 • Pacific Grove, via Arsalans • Time Warp • SW Kim Tribute, and more • Aaron, Tonio, and Google • From Malheur to Yachats • Local Socializing • Easements and Compost • Thanksgiving, Qatar, Bye to 2022, Next...

## 2018 Begins...

WITH THE FULL family in Pacific Grove at the upper Lighthouse home – and with the Blauers. We explored Washington Park, Asilomar, the 'Beatles' ice cream store, and of course BookWorks coffee house. Sylvia

demonstrated her gymnastics exercise routine, Josie learned about hands on banking. We all explored some of Pt. Lobos. Sylvia and Josie wrote little stories – and drawings – in my pocket notebook, and Amalia played some trumpet. We all left about the same time. Barb and I relocated back to the 7th St. Townhouse to continue our stay in PG.

We discovered the Steve Hawk Fine Arts Gallery at Fountain and Lighthouse in Pacific Grove. We talked with him. He took us on a tour, especially the upstairs section devoted to Steinbeck. We saw a photo of a Ken Kesey tapestry. Kesey was covered briefly in *State Change* and may have been connected to Steinbeck. Hawk is a Steinbeck fan and fiction author. He'd just published a little book of Steinbeck essays, fictionalized short stories stimulated by specific events in Steinbeck's history: *Steinbeck – The Untold Stories*, 2017. I bought a copy. Barbara and I read it over the next few days.

Stephanie and her Brian came by for a visit. Steph and Barb did some tide pooling. Brian talked, I listened, mainly.

Barbara and I walked every day, often for five miles or more. Our close friend, Karen Sweeney, rented the townhouse next door for a few weeks, and hosted her daughters, Alison and Megan, and her son Craig. We walked, talked, and learned of Craig's involvement with a cannabis firm in the Denver area.

Earlier, in July, 2017, I had hiked Mt. Olympus near my birthday. It was tough and grueling, but I felt good, although my lower back began to hurt. That was not unusual – I'd had mild lower back pain for many years, so I wasn't particularly concerned, but...

## Back Problem

I was limping more, putting more weight on my cane when walking uphill, and feeling more pain, so I took Ibuprofen and, being in California, began to assess the usefulness of cannabis. In mid-January I visited local dispensaries, tried cannabis tinctures, including Craig's product, learned of CBD vs THC, and read and studied about pain. The CBD tinctures seemed to help alleviate my relatively mild back pain, until very late January when the pain became more

severe. There wasn't a specific incident or movement that triggered it – it just got worse – and worse. I used more tincture and ibuprofen but to little effect. Then the pain became excruciating, the worst I'd ever endured. My lower back had obviously gone 'out'! It was nearly instantaneous and immobilizing. High doses of CBD (50 mg) and Ibuprofen did not help.

Looking back at my journal notes of January, 2018, I was worried that the pain might be the result of uneven wear in my artificial hip, which was already about 20 years old. So I made an appointment with Dr. Gililland, at the UU Orthopedic Research Center, who was following up on Howard Dunn's old patients.

On Feb. 4, our 52nd anniversary, we started driving home to Utah. I took a lot of Ibuprofen and much CBD, some THC as well. I recall taking up to 5 mg THC and feeling a 'buzz' and perhaps very mild perception effects – on Carmel Valley Road, headed for US 101. I concluded I'd need to keep the dose under 2.5 mg while walking or driving.

It was a very painful drive home. In Barstow we had a sleepless night due to all its train noise (the motel had placed ear plugs on the pillows for us!). We did stop in the beautiful Virgin River Gorge in Arizona for a picnic. I walked a short, painful distance down to the river, probably using both canes. Nothing I took did much to alleviate the pain. Fortunately, it was not as severe while sitting and driving.

Gililland and I met February 9, together with two of his residents. We discussed possible artificial hip inflammation or perhaps an implant-facilitated infection. x-ray showed my old hip was fine – only minimal cup wear after 20 years and many Mt. Olympus treks. We scheduled a near immediate MRI on Feb. 16 and a followup on March 2.

One of Gililland's residents was very interested in biomaterials. We talked about books and the history of the field. So during that second Gililland visit I brought a box of biomaterials books for the interested resident, as well as a bottle of Champagne for him to give to Dunn (now retired in Wyoming), in celebration of my 20 year old well functioning artificial hip.

The MRI clearly showed disc displacement in the L3-L5 lower back region, probably impinging a major nerve. Ouch! We discussed pain relief, including Ibuprofen and Meloxicam – neither helped. I was in very severe pain, had to spend much time flat on my back, couldn't sleep due to the severe pain, etc. It was awful.

I experimented more with CBD and THC and began learning about Kratom. Aaron suggested looking into *Salvia divinorum*, a mint-like plant. I also considered a range of ‘therapies’ to alleviate pain, including BFST, a diathermic device that stimulates blood flow deep within the soft tissue. The energy is applied via a wide belt – shaped like a brace. The electrically fueled energy is directed to the lower back, increasing the inner temperature and stimulating blood flow. No effect.

## Playing and Tripping with Pain

Barb worked with me to continue some social interactions. I recall a dinner at the Hibbs home where I had to move clumsily via my borrowed walker. It worked although I worried about the walker feet scratching their floor. On the way home we took Shahpar to her place, Barb driving. I was in great pain. I was embarrassed due to making noise, perhaps screaming, due to the pain. I needed to be on my back! We all endured.

I asked friends who I knew had experienced severe pain as to their means of addressing pain. Several suggested Tylenol, which I also tried. I tried sustained release, high dose Tylenol (from Canada) and many other preparations. It helped. Relatively high doses of CBD-THC helped a little. I looked into cannabis dispensaries in Nevada, as well as CBD (via hemp) availability in Utah. We even tried high dose aspirin to help alleviate pain.

I looked into alternative medications – Kratom and Salvia. Aaron and I, and some friends, had discussions on the pain-relief possibilities offered by such alternatives.

The Salvia arrived in late February. I experimented with tinctures and with chewing leaves using honey to decrease the bitterness. I started with very small amounts and worked up until I finally sensed a real effect.



Kratom, in a tea form, was also promising. I ordered various Kratom varieties, in powder form, to make teas of various concentrations. Kratom was reported to be opioid-like but different enough so as to be non-addicting.

Salvia was very interesting. Rather than a tea, one was instructed to chew and mash a large batch of the dry, chopped leaves, to permit sub-lingual absorption of the active ingredient. After some time, I think 5 to 10 minutes of energetic, tiring, chewing, the mash (called a quid) is spit out, followed by lying down to experience the effect.

Around noon on Feb. 25, when Barb was out, I was in severe pain. I intentionally did not take any pain meds because I had decided to try a high dose of Salvia – I wanted a real effect. I laboriously chewed a very large wad (quid) – some 3–4 grams of leaves – a palm full. I soaked the wad in warm honey water for 10 minutes, pressed the wad into a compact quid (about a tablespoon), and then started chewing. About 15 minutes later, Salvia began to perform:

As I walked from the kitchen to my pain room to lie down and wait, I felt a bit dizzy and slightly unbalanced. The world began to distort. My walker had some trouble contacting the floor, as the floor was undulating and gently moving. Colors and perception were distorted. I was actually experiencing a psychedelic ‘trip’ – my first! I made it safely to the bedroom, lay on my back, and just experienced the trip. There were walls – all plastic-like, multi-colored, soft, wavy, undulating. There were paths and tunnels leaving from the surrounding walls. It was all very colorful, not unlike the psychedelic art I had observed before.

And I could control it. I could feel the normal reality, and I could let myself slip into the Salvia-induced ‘reality’, and could experience them together, sort of like blending two semi-transparent images. There were sound effects as I had an audio course on at the same time. The background sound sort of modulated the colorful psychedelic images. The pain was always there but was less intense when I ‘focused’ on the Salvia world. Focusing on the real world brought back the intense pain. I could actually willfully move back and forth between the Salvia and real worlds. Fascinating.

I experimented with my own pain. I knew that certain motions and positions greatly exacerbated the pain. My normal position was on my back, trying to gently move and exercise my legs by lifting them straight up. I felt the expected pain – I recognized it – but under Salvia it was not as severe as expected.

## Obrigado Pela Vida

It was like a shade or curtain was covering the pain – still there but not as noticeable. Interesting. I think I could even get up and walk around.

And then, after 15–20 minutes or so – it was all gone, and the pain returned with a vengeance. I knew that a ‘dose’ of Salvia was not long lasting – that it would all be over in 15 to 20 minutes or so. Unless I wanted to become a constant Salvia chewer and spitter, it was impractical. I think it might have potential if the active ingredients could be concentrated and packaged as a sustained relief sublingual preparation.

In early March I began to make and study Kratom tea. Kratom is considered to have opioid-like effects but without the severe addiction properties exhibited by common opioid drugs. I made tea and drank it daily for several weeks, varying dosages and situations. I tried many different strains from several sources. It seemed to work, marginally. There were no dramatic effects.

I also continued to experiment with CBD as well as acetaminophen (Tylenol). Very roughly, Tylenol seems mildly effective for direct nerve pain, while Ibuprofen, an anti-inflammatory, was most effective for muscle pain. I experimented with various concentrations and regimens of Tylenol, Kratom, and CBD. The pain persisted, of course.

## Adios, Paul Dryden

Paul Dryden died Jan. 24, 2018 at the age of 68. We had talked at the Huntsman Cancer Center in late Fall 2017, just before Barb and I went to Pacific Grove. Paul had been a coworker and friend since the early 80s, when he moved back to Utah and began to work with me at UU. He soon began operating and running our new Surface Analysis Lab, providing ESCA analysis services for our research and the broader technical community. He was always cheerful, supportive, motivated, resourceful, and creatively helpful.

He loved the outdoors. In the mid-80s we went hiking with Vlado Hlady and with Paul’s first wife Camille. On those hikes we discovered the great properties of *Avelada* – a cheap Portuguese Vinho Verde. When opened and consumed at about 10,000 feet elevation, *Avelada* transformed to an exotic carbonated

‘champagne’! Paul was on the Cardiac Ridge hike with Vlado, Nina, Barb and me in mid-1986. This was one of the most spectacular of the Wasatch hikes we did together. Some years later he married Lillia, who taught him Spanish while he taught her English. They had three children.

His Celebration of Life event was on March 3, 2018. Barb and I attended – with me moving slowly on my walker. I talked briefly about Paul, our friendship, and his great work. Barb and I left the event early as my pain was getting very intense.

Paul was a natural fix-it man, builder, modifier. He built the extensive bookshelves for several of my offices, including the late 1987 one in the 4th floor of MEB. Later, when I set up the 2460 MEB office with a long row of some 14 four drawer file cabinets, he built wall to window bookshelves, resting on the top of the filing cabinets. Very efficient and convenient.

He taught himself microelectronics, coding and programming, and any other skills needed for his job. He slowly became more and more valuable to the Dept. of Bioengineering. With the development of the undergraduate bioengineering program around year 2000, and the phase out of the Surface Analysis Lab, Paul became a fulltime Bioengineering staff member, responsible for UC labs – and many other duties.

He knew of our coworker and friend Don Gregonis’ battle with cancer (Don died in 2016). So when Paul was diagnosed, he received his brain cancer diagnosis and prognosis with courage and resilience. There was a mild remission or two – we were always hopeful and cautiously optimistic.

Adios, Paul – and thanks.

## Before Surgery

After the MRI diagnosis and discussions with Gililand I opted to see a spine specialist, hoping physical therapy might help. I saw Zach McCormick in mid-March, 2018. We examined my situation and the MRI. I opted for spine steroid injection for my lumbar radiculopathy (lower back pain due to disc herniation).

## Obrigado Pela Vida

I also opted for physical therapy. I found a very good PT nearby, Irene Acevedo. We met at her clinic in late February. She had me do swaying exercise, standing in a doorway for support, to attempt to internally massage/coax the disc back into position. Good idea, I thought. But my disc was too far gone – after ten days or so of intense, painful PT, she agreed that my disc displacement was simply too severe to be corrected by PT alone. I had two (I think) spine injections, with no effect. So, surgery.

I met Nicholas Spina on March 12. We examined the x-rays and MRI, concluding that lower spine surgery seemed to be the only real treatment possibility. I agreed. He said there were two options:

Option 1: surgery to cut away part of the disc and do some local bone removal to minimize nerve impingement and thus alleviate the pressure on the nerve; or

Option 2: Option 1 plus an L3-L5 fusion to assure that the same or an adjacent disc does not cause a recurrence.

I discussed the two options with several friends and family – but especially with John Ray, a spine surgeon in our ‘family’. He was/is Nina’s husband, practicing in Fort Collins, Colorado. He examined my MRI and the medical visit reports, and agreed with the two options. I opted for the dual surgical approach – disc dissection and fusion. Surgery was scheduled for April 10, after a pre-op visit the day before. It would require 3–4 months to fully recover.

I had another epidural injection on Mar. 19 – again, no effect. That meant another three weeks of intense, nearly totally immobilizing pain. I had to sleep on my back, almost immobile. I listened to audio books to pass the time – and to eventually fall asleep while listening. That didn’t work as well for Gerry Elias’ wonderful music murder mysteries – they kept me awake, but distracted a bit from the pain. I acquired my own walker and could shuffle around with it. I also started to insist on effective pain medications.

We had experimented with a range of prescribed pain relievers – Gabapentin/Neurontin, Tramadol, 5 mg Oxycodone – none worked. Gabapentin probably initiated or contributed to my later leg swelling issues (a well known side effect of that drug). This was at the time that opioids had become belatedly recognized as dangerous and highly addictive. Physicians were appropriately hesitant to prescribe opioids. Spina finally relented. In late March I started taking 1–2 10 mg Oxycodone every 3 hours or so. One 10 mg pill worked for about three

hours, providing me with an hour or so of sufficient pain relief to allow me to read, concentrate, and work. During those few hours each day I focused my attention on pain. I read everything I could find that seemed useful and relevant. Many of those books are in my Amazon cloud-based Kindle library. To sleep I was taking oxycodone/hydrocodone and Ibuprofen every two hours. During the day I'd also take Kratom tea.

I insisted on staying on oxycodone until my back surgery. Spina and his team were hesitant, but the pain was very severe. I was indeed becoming mildly addicted, although I didn't know it then. Plus the opioids cause constipation. And when you do go, the turds are so large, rounded, and hard that they plug the toilet. Mayday! Help! That happened several times. Barb is a real trooper. We accommodated and endured.

## Distractions

I soon realized that an effective 'treatment' for severe pain is strong distraction.

In mid-March Art and Mira Janata visited us; they were in town to ski. Art had arranged for a chapter on Willem Kolff to be included in a Czech encyclopedia of famous, important people. We discussed it, as well as reminisced about the old days, including Mira's goodbye party – held at our place on Highland Drive in the mid-80s, before Mira returned to Germany.

I was also distracted by working on our taxes. I wanted to get them in before surgery, just in case... Before surgery I worked on and submitted the IRS 2017 tax papers. A boring duty, but a semi-effective pain distraction! Between the pain and the difficulty in thinking, they were likely the sloppiest taxes I had ever prepared. But Barb and I worked through them.

I worked on my 'legacy' web site – [joeandrade.org](http://joeandrade.org) – with Jacob Hanson. We organized the site, and I started to organize materials for scanning. I really wanted almost everything I had done to be easily accessible (and searchable) on line. Jake and I worked very hard over the next several years to make the legacy site a reality.

## Obrigado Pela Vida

Barb and I had hoped to be with the Decatur Andrades at Folly Beach in early April. We cancelled, but did plan to drive to Oregon for our family July get together. If all had gone well, that should have happened. It didn't.

On April 4, nearly a week before surgery and many, many weeks of living largely sedentary and on my back, I experienced very severe pain and leg swelling, so severe we went to the Emergency Room (ER) at nearby St. Marks Hospital. I received an iv pain med which really helped.

On April 6 our new bed/mattress was delivered. Thanks to David Blauer for helping Barb select and purchase it. Barb and I had never had a bed. We always used a box spring and mattress – right on the floor. But that arrangement was now too low – and the mattress too soft – for my back and for getting in and out of bed. Hence the need for a new system, with a real bed frame.

Another positive and effective distraction was my little brother, Manny, and his interest in acquiring some property of his own. He ended up focusing on an area just east of Redding, Ca. right off Highway 299, near a town called Round Mountain. We helped him acquire some 6 acres of essentially undeveloped foothill land, about 2500 ft. elevation, about 20 miles from Redding. We wanted to help him get something in his name – and before my surgery (just in case!)...

# Lower Back Surgery

I had a second ER visit the night before the April 9 surgical consultation – again for the swelling and the pain. I was a mess, almost screaming in the ER waiting room due to the pain. I clearly recall, as I was given an iv of morphine painkiller, feeling the pain subside as the injection progressed. It was remarkable.

The swelling was likely due to my living on my back for nearly two months. That apparently was also the reason for my middle ear otolith vertigo balance issues. On April 10, surgery day, I still had severe swelling and pain. We delayed surgery for several hours while the team tested me for heart and circulation issues, repeating what the ER had considered and ruled out. We decided to go ahead.

There was an unexpected (although it should have been anticipated) concern during surgery – I learned later. Doc Spina noticed and experienced my vertebral osteoporosis (not uncommon for a 77 year old man) as he attempted to install the fixation hardware required for the lower back fusion. Fortunately the screws held satisfactorily, but made him, and then me, very concerned about my bone physiology.

The surgery worked. Doc Spina had trimmed the disc, enlarged the vertebral tunnels for the nerve, and generally fused my lower back. I was given careful instructions as to allowed and especially unallowed movements, including getting in and out of bed. I was told to simply walk, as well as to NOT bend over or twist my back. I walked, initially with the walker, then with my two canes. Spina and I were concerned about the osteoporosis and potential bone plate fixation issues. He recommended I see Dr. Amy Powell, a specialist in osteoporosis; a DEXA-Scan bone density measurement was scheduled for May 9.

For two weeks after surgery I was in pain, though not as excruciating as before. I was still quite immobile, and had leg swelling. I was still on oxycodone and Tylenol, together with Kratom tea.

We had dinner at the Hladys' place on April 20, I think on their back patio. I must have been okay, as I can't recall being in severe pain or discomfort.

In early May I started to feel better. Spina had advised me it would be a slow process. The surgery involved getting through and around many lower back area muscles, all of which produced pain and would take time to recover. I received gentle back and leg massage via Carol Drown. I continued to study pain and means to treat or avoid it. I plugged the toilet another time or two.

Following the May 9 DEXA-Scan, which confirmed my moderate lower back osteoporosis, Docs Spina and Powell recommended I participate in a study on a semi-experimental drug for the osteoporosis: Forteo. This required a daily abdominal self-injection. I received a 30 day supply of the vial packaged drug and needles. Beginning May 21 I injected my tummy area first thing in the morning with Forteo. It was cumbersome, time consuming, annoying, but tolerable. That went on for nearly 9 months.

Tonio and Aaron arrived for a few days in mid-May to check in on us and help out. I was feeling fairly good; the pain was largely under control.

But then early on May 17, roughly five weeks after surgery, I had to send this email to Doc Spina:

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‘Urgent Andrade bending event this morning:

I have been feeling some moderate lower back pain for several days. This morning I was sitting trying to put on my slippers. Overall pain was moderate to severe. I brought the leg up and bent over slightly to get the slippers on. As I bent slightly more to complete the action, I received a sharp pain, I think a sound like a crack or pop, and intense pain. I straightened out and the pain stopped. I could then stand, move, etc. with no problems. As I sit here my pain levels are what I’d expect given the pain/pill regimen I’m on.’

Oops – clearly – shouldn’t have bent that far over.

Doc Spina and I were scheduled to meet on May 21. The x-ray showed a fine L-2 fracture but no issues with screws or plate hardware. An MRI was acquired on May 29, with Gd contrast enhancement.

Another email to Doc:

05/31/2018, 11:06 AM Andrade MRI, Gd followup: Regarding Tues MRI with Gd contrast enhance, I assume we are looking for why I still have intense pain, especially right leg, thigh, above knee, upper ankle. Would also like to discuss if my chronic edema has a role. The searching I did suggest that the opioids and conventional pain meds do not have significant edema side effects, except for Gabapentin and Lyrica, which I’m no longer taking.

I understand both edema and osteoporosis can be related to thyroid dysfunction. Can we discuss that? Also the lower back ‘pop’, intense pain event, I had some weeks ago. You noted there may be an L2 fine fracture. From then on the pain has been more intense.

Spina and I met June 4: He confirmed the new L2 fracture, the fixation of the lower back devices, and the advisability of continuing with Forteo. My thyroid-related test levels seemed fine. As my pain continued to be intense, as well as leg swelling, I was not getting the exercise we both wanted, which likely compounded my problems. We set up another spinal injection for June – no effect. I continued on opioids. I often wore a large back brace. Doc Spina even suggested I might have some L4 re-herniation!



The lower back fusion was a serious mobility constraint. Before the fusion I'd usually bend over to get to the floor, almost never squatting. That obviously had to change. I learned to squat – to get down and closer to the floor, to my feet. That required some conditioning, exercise, and persistence. It worked.

I was having serious balance issues. I saw my St. Mark's physician for the leg swelling problem. We talked about my varicose veins and considered surgery. He had me see Dr. Sohail Khan, a cardiologist at St Marks. We set up an appointment for mid-July to further consider lower leg venous surgery. At the end of our visit, we also discussed my balance concerns. He put me on the table and had me abruptly move my head and thus immediately diagnosed benign paroxysmal positional vertigo (BPPV) – the mislodging of the otoliths in my middle ear. He suggested I see a physical therapist with expertise in BPPV treatment.

Some weeks later, while very slowly walking along the track at the Mill Creek Recreation Center, where Barb had her yoga and zumba classes, Barb's yoga instructor, also a Barb, suggested I use trekking poles rather than canes. We purchased a used pair from her on June 14, and I've been using them ever since. My walking continued and improved. I was trying to get 'in shape' for our annual July trip to Manzanita.

The swelling problems decreased. The increased walking apparently corrected my lower leg venous circulation and thus the swelling. I was improving! No leg surgery needed.

I saw Dr. Powell again in late June to follow up on the Forteo regime. She said I was borderline osteoporotic and assured me that my back was not crumbling! – continue with Forteo.

On June 26 Sung Wan Kim and YK Sung visited me at home. A great pain distraction. We had a good time sitting by the creek and revisiting our careers, YK's PhD studies with me, and his current work with SW Kim. Then YK returned to Korea.

On July 3 I drove myself to the podiatrist for a toenail job. I couldn't bend over to cut my own toenails! It had been some four months of not driving. I was mobile again!

# Pain, Addiction, Distractions

Fortunately, my interactions with Bernie Hart and my service on The Leonardo Board helped provide some distraction from the pain.

Bernie is an exciting, creative, individual with a great sense of humor. He's a great positive distraction – and doing good things. We met in 2016, at the Nostalgia Coffee Shop in downtown SLc. He'd been talking with Charlie Jui in Physics on ideas related to gravity, balance, and mental health. I had talked much earlier with Jui about The Leonardo, creativity, and education, so he suggested Bernie talk with me – that I was interested in 'out of the box' perspectives. Bernie called, we met, we had great discussions. His ideas were very interesting, not crazy, in many ways very fundamental. So we kept talking.

Becoming reconnected with The Leonardo, and returning to service on its Board, also provided needed distraction from the pain. There I met Leonardo staffer and Development Director, Deb Peterson. She had worked as an assistant to The Leo's senior science advisor, Nobelist Mario Capecchi. We talked about pain. I learned she had suffered from similar back issues, experienced severe pain, was on opioids for significantly longer than I'd been, became somewhat addicted – and then quit opioids. I was impressed. If she could do that, so could I.

I knew opioids were addicting, but didn't know what addiction meant – what it felt like. It was a dark word, like cancer or terrorist. I assumed it meant addicted to pain relief, rather than to a specific drug. Not so. I studied opioid addiction, and getting off opioids. So... over a 10 day or so period, I got off opioids, and got more on Tylenol, CBD, and some THC. The THC improved my mood and thus tolerance to pain. And it worked. I did learn how 'addiction' felt (to me) and what 'withdrawal' meant. I'd been on oxycodone for three months. Had I taken opioids for much longer, as Deb had, the withdrawal process would have been much more difficult. Thank you, Deb Peterson!

E-mail to Doc Spina on July 4:

Andrade: Upcoming Jul 9 visit, discussion:

Based on lots of reading and discussions with friends who have had back surgery and been on oxycodone, I decided to try to get off the drug via a self-imposed dose taper regimen, dealing with the withdrawal effects,

and trying to develop a personalized pain management process. By July 9 I should be on only 1 to 2 5 mg pills/day. The pain is likely to be more intense than it is now. I want to talk about non-opioid pain management. As my leg swelling is getting under control, due to massage and increased movement/exercise, we may want to consider Lyrica again, also Ibuprofen as well as Tylenol. I understand muscle relaxants can help, especially Lorzone (?). I also want to discuss optimum posture, exercise, etc. Amy Powell is very good; the Forteo regimen, for 9 months, seems to be the way to go. I'll continue to see her, of course.

See you Monday. Thanks.

On July 9 Spina and I met – I was now off opioids. He did explain that pain management was likely now easier because it had been some three months since the back surgery. Back muscles heal slowly, especially in 77 year olds. It just took time. And breaking a vertebra certainly didn't aid that process! He agreed to let me start physical therapy at ORC, including hydro (pool) therapy.

Perhaps most importantly, the soccer World Cup was occurring July 7–15. And Croatia was a surprise finalist! Now that was a distraction!

My interest in pain had now expanded to incorporate drugs and withdrawal. Withdrawing from opioids produced a very different kind of feeling – a different, previously unexperienced uncomfortable sensation. Pain is often compared with itching. Although they feel very different, they likely share somewhat overlapping sensory mechanisms. For me withdrawal didn't hurt – it wasn't pain, but rather an intense discomfort – a very negative discomfort. Perhaps it can be considered an opposite to sensual, sexual pleasure feelings – not pain, not itch, but very unpleasant – overwhelmingly so.

The entire field of sensory feelings – pain, itch, withdrawal, sex, bliss, and perhaps various drug-induced feelings, as with MDMA and some psychedelics – could be the basis of incredible exhibits and activities for science centers and museums. 2018 had been declared a 'year for excellence in pain education'. The International Association for the Study of Pain (IASP) held webinars, lectures, and suggested books related to pain science and management.

But our hyper-political and hyper-'woke' cultural and political environment would make it very difficult for The Leonardo or other science-based centers and museums to develop such a program. And I don't have the energy or commitment to take the lead on such a project.

## Manzanita – 2018

Barb organized a home birthday gig for me on July 13, with a few close friends. We really wanted to get to Manzanita to be with the kids. I experimented with getting my body in and out of the Prius, trying to fit and stretch in the passenger seat. But it wouldn't work. I was too big and too stiff to fit. We would have to fly. Spina said that no way could I or should I drive to Oregon. I finally agreed with him.

I found a Portland firm that rented 3 wheel electric scooters for invalids – the kind in large grocery stores. I selected a foldup one that would fit in a car trunk. Paul Manda, Scott Newcomb, and Aaron agreed to pick up the scooter, deliver it to Manzanita, and return it later.

Scott and Paul picked it up and assembled it in Manzanita – at 783 Beach St. The granddaughters and I had a good time with the scooter for the week. Amalia even made scooter driver's licenses for people, after they were checked out on the scooter – by Amalia! I was awarded my own special scooter driver's license – after a road exam, of course.

The granddaughters were a great distraction for my pain. We rode the scooter, played, ate, and generally had a great time. I explored the local cannabis shop – via the scooter. I experimented with various CBD-THC tinctures and oral gummies.

Little brother Manny drove up from his place near Redding to meet his nieces and the family.

We all went to Portland for a great afternoon on the Willamette River. Glass of Hearts, the Blondie tribute band with Aaron as its keyboardist, performed on a Portland Spirit cruise up the Willamette for several hours – much music, dancing, good fun. Then Manny headed back to Redding with the rest of us going back to Manzanita. We spent several days in Nehalem Bay State Park, with me going slowly behind the group on that cool scooter, concerned that it not run out of charge. Scott, Aaron, and I visited the local dispensary, experimented more with CBD and THC.

Then it was back to Portland, a local B&B (ASPA, run by Michelle), walks in Westmoreland Park and on Mt. Tabor, more dispensaries. Paul and Scott returned the rented scooter, and we flew back to SLC.

I began PT via water therapy in the Orthopedic Research Center pool, which was a great benefit to my recovery and leg strengthening. After a month or so, I 'graduated' to 'independent' and could use the pool without direct guidance of a therapist.

I had continued to have balance issues and had to be extremely careful just walking, showering, and being. The balance problem was restored starting Nov. 1 via two sessions with Preston Ward, a physical therapist with the ORC. He corrected the positional vertigo with two abrupt from horizontal to vertical actions, more or less the standard protocol for routing positional vertigo disorder. It worked for me, and I've not had any further balance issues (as of 7-7-2022, Tonio's 54th birthday!).

Productive distractions included posting all my *Science without Walls* videos on YouTube, in part so Amalia and Sylvia might be interested. Jake Hanson and I met and worked on the [joeandrade.org](http://joeandrade.org) site. I was scanning, retrieving, and posting a career's worth of papers, proposals, reports on the site

After Manzanita, Barb and I decided that we could continue with our Monterey area winter 'escapes'. So we booked a place that didn't have extensive stairs – the 16th St. Retreat in Pacific Grove, just blocks from downtown and from Lovers' Point and the Coast.

## Pain Management

My optimized regimen for pain management has evolved to be:

500 mg Tylenol three times /day – about 8 am, Noon, and 4 pm;

20 mg CBD as oral gummy, twice/day – about 9 am and 3 pm;

1 mg THC as oral gummy, twice/day – also about 9 am and 3 pm.

I generally could purchase (in California and Oregon) gummies containing 20 mg CBD and 1 mg THC.

That regimen has to be supplemented by daily stretch and motion exercise – Miranda Esmond-White's Essential Stretch or Essentrics series on PBS works very well for me, coupled with several times per day on my back, legs straight up, rest and exercise...

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And lots of mental distractions and/or focus.

Tylenol is processed via the liver; there is a concern of liver damage due to long term use. My doctors think two grams/day (four 500 mg pills) won't damage my liver. I insist on a liver function blood panel every six months or so. So far my liver is fine. I still have a glass of wine nearly every day, but no more alcohol than that. If my liver starts to become damaged, the alcohol will have to stop, and perhaps also the Tylenol.

## Don Olsen...

'...was called home to our Heavenly Father on Aug. 5, 2018...', according to his *Salt Lake Tribune* obituary. Don and his family were committed Mormons. We hadn't seen each other or talked for several years. If Don's in some sort of Mormon heaven, I'm sure he's dragging his fellow dead Mormon 'brothers' on backpack hikes throughout their heavenly realm. Don was an avid hiker, camper, and outdoorsman.

He led a group in Fall, 1986 into and up Deaf Smith Canyon, very near his home. There were only six of us, I think, on a steep rugged hike, culminating near a ridge below Twin Peaks with a beautiful, rugged bristlecone (maybe a limber) pine. The canyon was accessed via some private land, but Don knew the way. A very special experience in a special place: the Twin Peaks Wilderness, one of three small, 10,000 acre or so wilderness areas just southeast of Salt Lake City. The Mt. Olympus and Lone Peak Wilderness border Twin Peaks.

Lee Smith, Dennis Coleman, Jim McCrea, and I went to his funeral ceremony, held at the LDS Chapel on Top of the World Drive, near Don's home, and nearly at the mouth of Deaf Smith Canyon. We all met for drinks some days later, probably at the Irish Pub in Olympus Hills, to remember Don and tell stories. We also recalled Don Gregonis, our friend and coworker, who had died two years earlier from pancreatic cancer. Don was the Shulgin-like character, Tom, in the harmless team in *State Change*.

It was also that August, four months after back surgery, that I started riding the bus again to the UU to continue writing this memoir as well as a sequel to *State Change*.

Barb worked in August on an art project which she then presented at an Artes de Mexico competition event. Her art 'sculpture' was titled *Los Desperdicios* – the throwaways, alluding to migrant children at the us-Mexico border.

In early September Spina and I saw each other; the wound and x-rays looked fine. I was feeling quite well. Then we traveled to Capitol Reef for a Salon 'meeting', staying in the Hatch's cabin. Jeff and Peggy Hatch, and Lydia and Tom Berggren – the other Salon host for the event – led us on a short hike just NW of Teasdale (which is just west of Torrey) – on Sept 21. It was my first hike since my back went out! For me, it was almost momentous. I didn't go far; I used the trekking poles, and I lay down for a time on a flat rock – on my back. It was wonderful.

In October I worked hard on The Leo's Da Vinci award event, working with the Jacobsen family and the team at Jacobsen Innovations to help plan the event and the recognition for Steve Jacobsen. Barb deactivated her Community Garden plot – it was our last Community Garden formal visit and activity. Also that month we transported all of her Le and Julian Williams art to our garage, and let go of the nearby storage unit. Barb had skin surgery at Huntsman cancer for a non-cancerous skin lesion, and I worked with Preston Ward to correct my positional vertigo balance issues. In early November we participated in the Unitarian Church fund-raising auction, where I met several old acquaintances and worked to reconnect then – philanthropically – to The Leonardo. We were and are not church members – it's just that they run a very cool fund-raisin'g auction. Also in early November I started working on the sequel to *State Change*, something related to the hard 'removal' of really bad and evil people – tentatively called *Removal – To Deliver Us from Evil*. Perhaps the subtitle should be The Case for Assassinations.

## Cuba – for Barb and Antonia

Barb's sister, Antonia, arrived about Nov. 6, and they then flew off to NYC and Miami to begin a 10 day excursion to Cuba – a Road Scholars trip. They had a great time, enjoying the music, food, people, and scenery. They visited several cities and regions, including Camaguey, Sancti Spiritus, Cienfuegos, Cojimar, Guanabacoa, and Havana. They returned Nov. 16.

While they were gone I did a ton of scanning, continuing to swell our digital photo library. Spina, Powell, and I had visits in mid-November, concluding that I would continue on Forteo for several more months. I worked with The Leo and Jacobsen Innovations on the award event, trying to reconnect with Steve's many colleagues and coworkers – and raising money for the event.

Then Barb and I packed up for the trip West.

## Back to Pacific Grove

With all my back issues, I could no longer do long drives. We were good for only 400 or so miles, with many stops for stretching and even short times on my back. We spent the first night in St. George; our next night was in Barstow, this time avoiding the motels near the noisy RR tracks, then on to Cambria, via Bakersfield and across. This was our first time coming in along Highway 46. About a third of the way from I-5 to Cambria, but still East of Paso Robles, we came across the James Dean Memorial and spent some time studying the displays and quotations. All we knew about him was *Rebel without a Cause* (with Natalie Wood!). It was fascinating to read his views on living, dying, and death:

“If a man can bridge the gap between life and death...

if he can live on after he's dead, then maybe he's a great man.”

“Dream as if you'll live forever. Live as if you'll die today.”

“Death. It's the only thing left to respect. It's the one inevitable, undeniable truth.

Everything else can be questioned. But death is truth.



In it lies the only nobility for man, and beyond it, the only hope.”

From that sobering stop, we rolled on to Paso Robles and then to lovely Cambria for the night at Cambria Pines Lodge. We walked a bit on the Fiscalini Preserve bluff trail, enjoyed revisiting downtown, and ate!

Then on to Pacific Grove via Big Sur on incredible Highway 1 – to the easily accessible 16th St. Retreat in Pacific Grove, just two blocks from Lovers’ Point and downtown.

Mid-December was my last Forteio shot; I then started taking Risedronate monthly, as a pill.

I worked on The Leo’s da Vinci award and gala. I worked on this memoir and continued to plan *Removal*.

Barb worked on her *Innocence Abroad* PCV memoir. She was going through letters and her notebooks – and writing.

We saw a Buddhist solstice ceremony on Lovers’ Point beach. Aaron joined us at the 16th St. cottage, on the couch!, just before Christmas.

The Decatur team arrived right after Christmas. We were unable to book the upper Lighthouse place of the year before. We had a Big Yellow House on 5th St., nearly at the corner with Ocean Ave. Aaron joined them there for the week. The kids were into making videos – and they did an especially creative, humorous project we all liked, called ‘Knock, Knock’. There was a small public park nearly across the street, largely unknown and unused. It was steep, rocky, and wooded – the girls loved it. We called it their Private Park. Josie set up her lemonade stand in front of the house.

I arranged for some trumpet lessons for Amalia with Kurt Heisig in Monterey. He has a trumpet and musical instruments store in downtown Monterey and was an avid teacher. He encouraged Amalia to play with energy and passion, discussed the novel mouthpiece he’d sold me the year before, when I first met him. He talked about technique and style. Amalia was a bit overwhelmed at first, but stuck with it and learned a lot.

We had a great time. They all left shortly after New Year’s – and we continued in our small 16th St. Retreat.

## House Hunting

We did so well in our single story cottage that we began thinking again of PG cottage hunting. We started to go to open houses. These are great education and entertainment. You get to see a different house, on a different street, with different people. Every week there are ten or so open houses. A good adventure on a rainy day.

Barb made it clear that she needed her close friends in Salt Lake City – low oxygen and polluted air would just have to be endured – friends were far more important to her. She didn't see living in Pacific Grove for more than six months of the year was a possibility. I was fine with that. I figured if we could get away during the coldest, the hottest – the most polluted months – we'd be in better overall health. Living in PG six months in our own home financially equated to renting a home there for six months. The other six months it would be empty – but made available to friends and family.

In early January we sort of began actively house hunting. We figured that we could afford just up to \$1 million. We could pay half up front, and get a mortgage on the rest. Rates were relatively low. I talked with TIAA-CREF, my retirement plan. We had three different accounts, stemming from my nearly 50 years with the UTU. After some discussions with TIAA, we chose to fully cash in one plan to have the cash on hand to put significant money up front. We talked with TIAA mortgage (they were new to the home mortgage business) about a half million dollar mortgage on a one million dollar property in Pacific Grove. It would be very feasible, we all concluded. So hunting we went.

After viewing several homes, one very rainy January day found us at 214 8th Street, with a For Sale sign on it. It looked very interesting. We walked in (it was an Open House) and met Emma, the realtor's rep. She welcomed us and showed us around: two stories, fully remodeled, no garage, steep hill at back of property, well equipped. Just under one million.

We were looking for an easy access place, given my now permanent lower back dysfunction. This house had that AND had an upper story with bedroom, bath, and other space. We could live on the first floor – guests on the second. We could accommodate our extended family – for short visits – without great difficulty. We did our homework, home inspection, lots of questions, and decided

to make an offer – for \$500. over the asking price. We asked Emma to represent us as the potential buyer, and she did. She was new at this so her Realty boss served as the Seller agent and aided in the overall process. I proceeded to free up the TIAA cash and to expedite their mortgage discussions – now with a specific property in mind. The offer was submitted. We waited.

I was thinking, pondering our age and my physical issues, about equipping, occupying, maintaining, and managing a second home. I concluded that, with some help, perhaps Danny Blauer, Aaron, and several others, we could manage this. We considered the finances, the mortgage payments, the property taxes, utility costs – all were manageable. We talked with the kids; they did their own homework for us. We waited.

Several days later, walking the coast trail near Esplanade Park, Emma called. “Are you sitting down,” she asked, expectantly.

“Just a minute,” I said.

We crossed the street to sit on a bench in the Park, then she continued:

“I have an ‘Over the Moon’ message for you,” she purred – that was the name of her Realty agency.

“They accepted the offer!” She was so excited.

Barb and I looked at each other, perhaps somewhat less excitedly.

What now? We called the kids. They weren’t quite as excited. We talked. They did more homework. Tonio finally convinced Barb that this was really not a good or prudent idea – that at 76 and 77 years, it would make life more complicated for us, and perhaps actually constrain our mobility and flexibility – and even our finances a bit. They were not concerned about inheritance.

Would we be able to continue to walk, to drive, and for how long? So on Jan. 14, we met poor Emma and reneged on the offer. She was so disappointed, of course. We felt bad, then relieved. The house was sold some months later, and again two years later. It’s gained in value by perhaps 20% – and we’re still – so far – moderately healthy and functional. Oh, well!

We were now in 2019 – and very happy that 2018 was over. It had been a very difficult year. Little did we know that 2019, starting late in the year, would present its own historic complexity and problems.

On January 17 we had our first experience with medical issues in the Monterey area. Barb felt some chest pains. We found an Urgent Care in Monterey. She was seen. A particularly thorough examiner ran a low resolution

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ECG and concluded she should go to the ER at CHOMPS: the Community Hospital of the Monterey Peninsula. It was on the Holman Highway, very near Highway 1. We went, waited, and she was cleared of any heart or ECG issues.

We were quite impressed with CHOMPS. It alleviated my concerns about the availability of medical care just minutes away from where we are living and staying.

We were visited by Stephanie and Brian, and later by Tom and Judy Hogan. It was also the time of King Tides, very high tides which produce great surf – thunderous, spectacular waves.

Pierre and Sue Sokolski (he is the former Dean of Science at UTU) – now PG permanent residents – hosted us for lunch at their newly remodeled home, just next to Esplanade Park.

## Home Again

On Feb. 5 we headed home via Cambria, Carpenteria, and the Arsalans in LA for a few hours. Then it was up to Simi Valley to see Aerovironment and pick up Paul McCready's Leonardo glider model – a gift from Aero to The Leonardo. We gently and carefully laid it on top of all the stuff in our well packed Prius – and headed back to Utah, via Barstow and St. George.

Barb hauled me to an RDT Gala and concert. Blauers came by for the second half of the event – the event ended with them and Barb dancing enthusiastically on the dance stage.

Steinbeck was a key focus for me in April. His Nobel speech dealt with Nobel's motives and goals in setting up the Prizes. Fascinating. I kept packing up books to give away.

The Leo took up much of my time – planning for the da Vinci prize event and gala. This was the 500th anniversary of Leonardo's death, and the second year after Steve Jacobsen's death.

My brother Bob died on 5-20-2019 in his home in Louisiana. He had a severe stroke in 2017. There was no formal funeral.

In June we traveled to Moab and Grand Junction to visit the Rabanals. In a touristic drive through downtown, I spotted the Trumbo bathtub sculpture! Barb and I had recently seen *Trumbo*, a film which fascinated me. He was blackballed by McCarthy's anti-Communist crusade back in the late 50s, but kept writing. A great story. We visited and walked with Becky in Colorado National Monument – our first time there.

Barb had finished her *Innocence Abroad* PCV memoir, Aaron did the layout, and we had it self-published in late June, 2019 at an Alphagraphics shop near downtown. We were all pleased with the result.

In early July I had a visit from Dr. Luo, one of my former students, who'd settled and been working in NYC. He had learned about my back, pain, and mobility issues, and wanted to help! During his graduate days in my lab we talked occasionally about Traditional Chinese and Western Medicine, the Qi (Chi) ideas and principles. He was quite a student of Oriental Medicine and had a part-time practice in Queens. He came on his own dime, stayed at Little America, and wanted to help. He did. He taught us about peripheral (legs, feet) circulation, various exercises, and other approaches to decrease pain and maximize mobility. We connected him with our massage therapy friend, Carol Drown, who gave me a massage occasionally. He and Barb discussed healthy cooking, especially preparing vegetables – and tofu – by simple steaming. We all learned a great deal.

And then it was back to the Oregon coast, this time via Clear Lake to see Barb's brother, Rhys, and his home and projects. We then routed up I-5 to Redding and US 299 East just short of Round Mountain, to visit Manny – his six acres are roughly at the corner of 299 and Buzzard Roost Road. Stephanie and Brian met us there. We had a rugged, impromptu picnic, 'toured' Manny's RV and property, met Manny's friend Barb at a motel in Redding, and then we headed along 299, now to the west, to Weaverville, towards the Coast. We stayed in Weaverville, then headed via Willow Creek, to just north of Eureka to catch US 101.

Then up to delightful Brookings and its wonderful (but now closed) passion fruit-containing FirstRise Bakery Cafe, and on to Yachats, where we discovered their new community center and park. Walking in Yachats we came across a front yard exhibit art installation titled 'No Kids in Cages', with a large doll (kid) in a literal cage. This was a comment on the new Trump-era 'policy' of

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separating refugee kids from their parents at the us-Mexico border. We also explored the park and related coastal areas just south of the Yachats River.

We rolled into Manzanita to our rental about a mile south of town and close to Nehalem Bay State Park, discovering a functioning hot tub. Mandas rented a house a block away. We ate super-pies, celebrated birthdays, walked together, hot tubbed, played games, and explored the park. Another great time in Manzanita. Then off to Portland and a street party at Mandas' place, celebrating Antonia's 70th. Aaron's band, Veteran Cosmic Rockers (VCR), played in the middle of the street, where the dancing occurred. The girls manned a Manda-supplied snow cone stand for our refreshment. Then it was back to SLC via Boise.

The first week of August old friend Dennis Olsen arrived for a brief visit for talking, walking, eating. We put him to work grilling something on our solar panel-powered electric grill.

Later in August Barb, Fanny, and her Mom, Maru, went to NYC to explore and walk. They met up with Pat Arnow, Barb's cousin and great tour guide – ferry rides, bridge walks, parks, site-seeing.

## Chuck Bowden – John Hibbs – and Atlanta

On August 30 I attended an event at Ken Sanders' Rare Books to commemorate the five year anniversary of Charles Bowden's death. My first introduction to Bowden's writings and work was via his 2014 NYT obituary. I wanted to know more. He died in 2014 at the age of 68.

He was an incredible journalist, writer, and philosopher – a close friend of Ed Abbey – and of Ken Sanders. His Wikipedia entry notes:

'He was known for his writings on the situation at the us-Mexico border and wrote often about the effects of the War on Drugs on the lives of the people in that region.'

He was called America's most alarming writer and also the best writer you've never read. I purchased several of his books at the Ken Sanders event, read them, shared him with John Hibbs, who also became a fan. We discussed Bowden's remarkable *Blood Orchid: An Unnatural History of America*, 1995 – his take on the systemic violence and corruption at the roots of American society. We also discussed the more recent *Some of the Dead Are Still Breathing: Living in the Future*, 2018:

'How can a person live a moral life in a culture of death? – and destruction.'

His writings, as was he, are gutsy, penetrating, ruthlessly honest and objective.

Some years later Barb and I were talking with Françoise and John about our Paria Canyon-Buckskin Gulch adventure, which led us to recall Edward Abbey's *Desert Solitaire* and his chapter on a flash flood. We also noted *The Monkey Wrench Gang* and the call of constructive activism. Françoise smiled and noted that John, too, is an activist. John is tall, gentle, bearded, mild-mannered, calm – no one's perception of an activist. At her prodding, he told his save Red Butte Creek story:

In the late 80s, perhaps early 90s, one spring day, he looked out from his lab window and saw and heard some men sawing down trees bordering Red Butte Creek. Red Butte is a largely pristine canyon east of and adjacent to the UU campus. It flows down through Research Park and into the Veterans' Administration campus, where John worked. His lab then was in a building very close to the creek. It was wooded, semi-pristine, cool, and natural. He inquired of the workmen, learning they had the job of clearing the trees and channeling the creek, for safety reasons! The real reason, John learned after several phone calls, was that the local VA had funds in its current fiscal year budget which, if not promptly spent, would have to be returned! Horrors! One simply cannot return unused funds. So John and his labmates went out to the work area, fortunately just temporarily vacated by the workers for their comfortable lunch, and retrieved many of their tools, perhaps keys, and other materials – storing such in their VA labs. And he threatened to call the police if they returned to work. After more calls he threatened the VA administrators by saying he'd contact the *Salt Lake Tribune* and get them to tell the story. The administrators could not tolerate such investigative, transparent journalism. So a section of Red Butte Creek

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on the VA campus was saved. Many years later John said, "...looking back, that's probably the most significant thing I'd ever done!"

Mild-mannered scientists can be effective eco-activists.

The big event in September was in Atlanta! We stayed with our granddaughters while Andrea and Tonio went to Jamaica to try a psychedelic therapy session, which didn't fully materialize. We rode MARTA, Atlanta's light rail system, explored their local park and neighborhoods, went to the Coca Cola museum, Sylvia and Barb went to a youth author lecture. Sylvia is a great navigator and auto driving safety advisor! We ate, played, and had a great time – and, of course made it to a local library.

There were other events – amigas parties, a SLC protest event, Unitarian Church fund raisers, and various Artes de Mexico Fanny-inspired workshops. Fanny met Jane Goodall in SLC. In October Fanny was in Oaxaca and sent many photos of her indigineous craft and cooking adventures. And we acquired a new iPad, to replace Barb's tired and slow iBook.

## Portland to Pacific Grove, via Bandon

Portland beckoned, via Baker City, in late November, as Aaron was doing a gig with Louder than Moz – a tribute to *The Smiths* – in downtown Portland at the Bithouse Saloon. Great event – we even danced a little; I was partially 'pole-dancing' (trekking poles). We enjoyed downtown Portland and revisiting Reed College. I pointed out to Barb several Reed scenes used in *State Change*.

Then it was on south via lovely Bandon and Brookings, rolling into the 16th St. Retreat in Pacific Grove on or about Dec. 1. We explored. I 'discovered' the beautiful Hopkins Marine Station Library and made it a preferred writing spot for me. Aaron arrived just before Christmas – the Decatur team arrived Dec. 26. They, and Aaron, moved in to the upper Lighthouse home again. Soon pies appeared; and another Heisig trumpet lesson for Amalia. Kurt insisted she



needed to know about his favorite trumpeter, Claude Gordon, and printed out some advice and lessons.

Aaron played piano at Asilomar, Josie did another bank visit with the coins from our generally full pink piggy bank. We attempted a group hike at Garrapata Park, until Aaron, then the rest of us, discovered an infestation of ticks. The girls screamed and ran back down the trail. They were well tuned to the problem of ticks in Georgia! We did walk the coast part of Garrapata, which was tick-free.

They all left about Jan. 5, 2020; we vacated the large house, back to 16th St. retreat, and to our quiet eating, walking, and writing. We'd walk to Washington Park, Asilomar, Esplanade, the Great Tide Pool, Pt. Pinos, and into Monterey.

There had been some ominous hints in late December about some new virus from China?

## Carmel Meadows, to SF, to SLG

Very early in 2020, while waiting for a table at the nearby Beachhouse Restaurant, Barb and I approached their bar for a drink. We sat adjacent to a local couple – and started talking. After a few minutes they told us of a wonderful walk, in ‘confidence’, as it wasn’t widely marked or known – and they’d like to keep it that way! Based on their directions, a day or two later we drove to Carmel Meadows, just immediately west of the Carmel River and North of Pt. Lobos. It was a high end residential area perched on a small bluff, overlooking the Bay and the Pacific. There was an easy trail running North-South in front of the bluff. Beautiful, delightful. It even had a few benches!

Sasha Hattori visited us in her classic Miyata sportster in mid-January – we just walked and talked. Barb did some volunteer Coast Trail weeding in mid-January.

For Barb’s 78th birthday, we were meeting Antonia and Paul in San Francisco. On the way there we visited Judy and Tom Hogan in Los Altos. We

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talked for an hour or so, then headed to SF, getting to the Beresfords Arms Hotel on Post Street, where we parked the car for the next several days. A key destination was the incredible JR exhibit at the SF MOMA. We met the Mandas, visited MOMA, had dinner at the classic restaurant where we'd dined together after the 2006 Le and Julian Fort Mason event, and – from there – called cousin Pat Arnow in Manhattan.

We walked, toured, ate, and talked. We routed back to Pacific Grove on Highway 1 (19th Ave.) to see the impressive 16th Avenue tiled-mosaic steps, and enjoyed the views from one of the highest points in San Francisco.

On Barb's birthday, with the Mandas, we did the Carmel Meadows walk, brunched at Clint Eastwood's place in Carmel, and chose the Mezza Luna! restaurant for dinner – with carrot cake! Barb and Antonia wanted to celebrate via dancing. Paul located an event at the Monterey Hyatt-Regency Hotel. We danced and made it home safely. Another exciting Birthday by Barb!

Then we headed home – the long way. We first drove north to Cotati-Santa Rosa to see Manny and his roommate Barbara Rossi – at her apartment. Then we routed around the North Bay towards Vallejo and then Stockton to catch I-5, then I-101, to Cambria for the night. We walked the Fiscalini Bluff trail again. At a very small downtown restaurant we saw that Alexandria Ocasio-Cortez and her boyfriend had lunched there some months earlier. Then it was on south to see Aarsalans in North LA, present Nadia with a really cool art kit, ate lots, harvested oranges and grapefruit, and then on to Las Vegas.

We were trying to get home before a large storm would hit Utah's I-15. We stayed in Las Vegas at the Berkley Hotel, attached to a casino, of course, and almost on the Strip. From Vegas it was straight to SLC just ahead of the storm. We woke the next morning to a lovely view of three or so inches of snow! The bad news – we discovered a very recent sewer backup downstairs, requiring cleaning and roto-rooting.

## Henry Kopecek's 80th, and SW Kim's Last

The last major scientific meeting I attended was the Salt Lake City/UTU International Symposium on Biomedical Materials – in honor of Henry Kopecek's 80th birthday. It was held on campus over two days, Feb. 7–8. Many old friends and colleagues participated, including sw Kim, Allan Hoffman, Nick Peppas, David Tirrell, David Grainger, Ian Feijen, Teruo Okano, and many more. Kopecek's keynote talk was titled My First Sixty Years in Science. The banquet talks featured slides and reminiscences by Pavla, David Grainger, Sung Wan and others. I talked with Allan Hoffman, reminding him of our early history and his kindness towards me back in 1968, when he was at MIT and I was visiting. He had showed me the Boston Metro and some sites in Boston. But he couldn't remember! I also had brief discussions with Sung Wan, who looked a bit tired, but otherwise OK. He died several weeks later. It was a warm, pleasant event.

Nina was with us on Feb. 9 for a ballet concert with Sissi Eichwald. This was just weeks before the recognition of the COVID-19 problem and the ensuing pandemic. In late February Italy had been recognized as a COVID hotspot; USA cases were becoming evident in the Northwest.

sw Kim died on Feb. 24. His funeral, on March 1, included many traveling in from Korea and Japan. Although COVID-hesitant, Barb and I went. Masks were not yet being used, except for a few from Korea and Japan, where mask wearing is far more common. It was difficult to keep distance (that guideline had not yet been promulgated).

We also attended a Feb. 20 event at The Leonardo – the opening of a The Leonardo collaborative exhibit with Roots of Peace, founded by Heidi Kuhn. The exhibit was called From Mines to Vines. I'd long been interested in the plague of land mines, their banning, and their removal or inactivation. We attended a large gala – I doubt we were masked at that time. The official CDC line at that time was that masks would not be very effective. That soon changed.

## It's a Pandemic!

On March 12 the WHO officially declared COVID-19 a world-wide pandemic. In mid-March certain states and school districts issued regional lockdowns; there were selective travel bans; the CDC and Office of the President issued social distancing recommendations; in early April masking was recommended nationally. President Trump downplayed the danger and risk until late March, after most of the developed world and many of the states had recognized the gravity of the situation.

And on March 18, we woke to a shaking home – the Magna 5.8 Earthquake! Quite scary. We stood in door jams. When the shaking subsided, we got our pre-stored earthquake emergency backpack out, and waited for aftershocks or a bigger quake. We were earthquake-conscious for a week or two, updating our emergency kit and doing some additional earthquake-‘proofing’. We had no damage, but Magna was hit quite hard. A real wake-up call – at least temporarily.

We stayed home – everything was closed; we were more or less locked down. We washed our veges, scrubbed surfaces, were cautious. Neither the CDC nor the political leaders knew much about the virus – a lot of mistakes, misperceptions, ineffective recommendations – all leading to public suspicion of ‘authorities’, of medical advisors, of CDC.

I had ordered some masks. We made our own from our discarded political T-shirts, including the classic Andrade for Congress shirts. We posted on about March 27 a video to YouTube on how to simply make a mask from the short sleeve of a dissected T-shirt – Barb is the demonstrator and star!

The pandemic and various stages of lockdown went on and on. Trump had by Federal omission largely delegated the entire response to the uncoordinated states, leading to confusion, ineffectiveness, and conspiracy theories.

I began to work more on this memoir. Jake and I expanded work on the legacy website, and I continued to work with The Leonardo.

Barb and I worked with our estate lawyer, Natalie Segall, to update our will and related documents.

Rather than send occasional funds to Manny, I initiated an auto-monthly payment to his account. With the lockdown and semi-quarantine he couldn't work. Fortunately he was living in Santa Rosa with Barbara Rossi.

We cancelled our trip to Manzanita. This was especially hard because Aaron's 50th birthday was June 20. But we all took it in stride, of course. We wanted to do something special for him. Tonio suggested a really good piano, to replace the somewhat compromised one he had. We worked with Tonio, the Portland Piano Company, and – with Aaron's direct help – selected a beautiful Kawai and had it delivered to him. We were all pleased.

I needed a project so decided to install a solar pump to pump water from the creek with which to deep water our trees – suffering from the prolonged drought. I spent substantial money, perhaps \$1500 total, and lots of time – but it never really worked well. I finally gave it up – all the parts are carefully packed in the garage for our curious inheritors!

We continued some social interactions – now outdoors, socially distanced, and masked. In mid-May the Hladys hosted us for a dinner on their deck. Later in May I had a virtual meeting with Spina and Powell on my back issues. There were no real issues or concerns.

In June 'Uncle' Scott visited, towing his tall but small, rugged, all weather camper, attached to the large Subaru he had to get to haul it. I guided his backing it onto our driveway until I heard a crunching gutter sound. Oops! The camper was taller than I had assumed or perceived! The gutter's actually fine – we now refer to it as Scott's gutter art.

We expanded our social repertoire and resilience by cleaning up and setting up the concrete slab east of our garage – the solar clothes drying area. I took down the clotheslines and cleaned up the area. We hung a sheet on the garage concrete wall, set up my old computer projector, waited till dark, and showed *The Mafia only Kills in Summer*, an Italian show we were fond of – to Fanny, Miriam, and their families. They were in carefully spaced chairs, had some dispersed food and snacks, and watched and talked – distanced and even masked.

## Pacific Grove – in July

With Manzanita out the window, due to travel and safety lockdowns, Barb and I chose to go solo back to Pacific Grove. Our trips there had always been in

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winter – why not summer? The 16th St Retreat which had worked well for us earlier was unavailable – it had been sold. So Monterey Bay Rentals suggested a place called Casa Simpatica, practically on Lover's Point (108 Forest St.). It was a small adobe-style 1 ½ bedroom cottage. We booked and went for a month, beginning on my birthday, July 13.

While packing for the trip, we realized how important and helpful ping-pong had been to our months of containment, confinement, and sanity. So we experimented, and realized we could actually pack our foldable mini-Pong table in the Prius, with little compromise in overall storage space. Cool.

We routed via Winnemucca and overnighted in Carson City. When we checked in, the clerk presented us with a small cake, fruit, and goodies – a remote birthday gift from Tonio and the team in Decatur. A total surprise!

We routed that way because I'd read of another major road over the Sierras – State Highway 88 to Stockton, normally closed in winter. It was a delightful summer drive. We spent some time at a Donner Party – Mormon monument near the Carson Pass summit, recognizing the Mormon pioneers who trekked west. I noted there was a connection to the trail to Lake Winnemucca, several miles south of Highway 88. We'd 'discovered' Lake Winnemucca back in Summer, 1965, thanks to Igor Skaredoff. Barb and I got to know each other better in my little pup tent, in the rain, in a lightning storm. Our advice to all new couples became:

'Go camping together, in the rain, in the cold – if that's a good experience, it might work.'

From Stockton we routed via I-5 to Los Banos and I 52/I 56 to the Monterey Peninsula, arriving at the pleasant and convenient Casa Simpatica. I wrote, we played ping-pong, walked, and listened to podcasts and webinars. We walked the lovely coast trail, avoiding other walkers and generally keeping to ourselves.

In mid-August, just before leaving for Salt Lake, we tuned in to the virtual service and celebration of Jarmila Janatova, organized by her kids Petr and Jana. Jarmila was an early and late colleague – beginning with the albumin work in the early 70s and ending with supervising Xiaoyun Yang's PhD work in 2006. She died on my birthday a month earlier. Then it was back to SLC, avoiding the many forest fires then blazing in California.

## From Tree to Stump

On Sept. 8 a very powerful windstorm resulted in a mid-morning intense ‘crack and thud’ sound coming from our back yard. Our lovely and healthy large blue spruce had succumbed to the intense, chaotic winds, falling to the sw, barely hitting and only slightly damaging our bridge. Nearly all our trees had been injured or killed by beetle infestations and drought stress over the last ten years. The 50 ft tall and 50 year old blue spruce seemed to be the healthiest of them all. We called our tree guy who appeared some five days later, clearing the wood and branches, leaving us with the stump and several large trunk pieces. I fixed the bridge. The *Tribune* called it a ‘hurricane force windstorm’. Earlier in the day I took some pictures of other trees, including a creekside leaning massive elm, which – if it fell – could take out our garage. But all the trees I suspected stayed standing. Only the blue spruce came down; it did have a shallow root system.

Barb and I thought we should and could do something with the nearly three feet diameter stump, which was only partially wrenched and twisted from the fall. So I promptly ordered a six foot, two man cross-cut saw, with a two week delivery estimate. Danny Blauer and I got to work cutting the roots and otherwise freeing the stump – and waited for the new saw. With the big, cool saw in hand, Danny and his friend, Graham, finally cut the stump and repositioned it to serve as a rustic garden table, where it sits today.

I kept scanning and writing. Barb kept weeding and harvesting. We celebrated Fanny’s October 4 birthday.

The Leonardo awarded its da Vinci Prize to Chris Johnson – virtually. I reconnected with Tom Bowman, a former consultant for The Leonardo; Alex Hesse and I then had regular phone/Zoom discussions with Tom on the future of The Leonardo. This went on for the next 12 or so months.

We woke up to snow on Nov. 8, which was a clear omen for our celebration of the election of Joe Biden – and hopefully the end of Trump and Trumpistan. Wishful thinking!

We learned of the success of Pfizer’s revolutionary m-RNA-based COVID vaccine. We all felt a great relief knowing we’d soon be able to get vaccinated against COVID-19.

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A few days later I learned that old colleague, mentor, inspiration – and then problem – Donald J Lyman had died on Nov. 14.

And on Nov. 21 we were off to Pacific Grove, via an overnight in Barstow, then on through Bakersfield, arriving at the lovely Casa Simpatica on Nov. 23. I worked on this memoir and participated in Bowman-Hesse discussions on The ‘new’ Leonardo.

We had booked a cool house called Captain’s Castle for the Decatur team for their Christmas through New Year’s visit with us, but a COVID upsurge caused the State of California to issue a Northern California travel ban order, which meant they could not come, and neither could Aaron. Fortunately the rental costs were refunded, as were their tickets, but it meant a lonely holiday season for Barb and me.

My very first PhD student, Hai Bang Lee, was to celebrate his 80th birthday on Christmas Day. I wrote a brief piece for a congratulatory volume put together by his Korean colleagues. Happy Birthday, Hai Bang!

## Pandemic Year 2 – Vaccines!!

Writing in January, 2021 focused on the very early days of my technical career – on the early 70s: DJ Lim, hydrogels, and water. I also reviewed the travel info on our old passports to help fill out details in the memoir writing. It was a very quiet time. Pacific Grove was largely locked down and free of most of the normal out of town folks.

We were appalled by the Jan. 6 insurrection by Trump and his avid, rabid supporters, and then pleased with the inauguration of Biden on Jan. 20. We thought back to four years ago, in Madeira, watching Trump’s inauguration on RTP – *Rádio e Televisão de Portugal* – and fearing the near future.

We quietly celebrated Barb’s 79th birthday on Jan. 25 and our 55th wedding anniversary on Feb. 4. Then we headed home, via Barstow, arriving Feb. 7. We quickly scheduled our first COVID vaccination for Feb. 23 and the second on Mar. 16. We optimistically assumed the availability of the vaccine would



bring COVID under control, so we began making plans for the annual July Manzanita reunion.

The Leonardo would be ten years open in October, so we postponed the Da Vinci Award Event to coincide with the 10th anniversary celebration.

We started to socialize again – distanced and masked – with Hladys, Hibbs, Shahpar, and I with Hugh. We went back to our respective hairdressers – masked, of course. And I wrote...

In May I began pool physical therapy – and kept remembering, researching, scanning, and writing. We had several Amigas Latinas events in May. On June 6 we hosted a graduation reception for Juliette and the Blauers

Barb organized a small 9–11 am outdoor brunch 80th birthday celebration for me on July 5, with Hibbs, Hladys, Alex Hesse and her family, Suzanne Winters, Shahpar, Miriam and Carmen, Carol Drown, Hugh Bollinger, and Henry Kopecek. It was a very pleasant and nostalgic event.

A week later we were off to Portland and Manzanita. We routed to Winnemuca, then on to Denio Junction, Lakeview, Bend, and Madras. At the Denio Junction I picked up a small flyer titled Friends of the Denio Library. We'd never been there – it was a few miles further north of the Junction. I was impressed with this tiny community's ambition in improving its tiny local library. When we returned to SLC, I wrote a check and we became Friends of the Denio Library.

We stayed in Madras July 13 at a motel which was adjacent to a Mexican restaurant. We usually let the kids have our itineraries, so Tonio again knew where we were staying. After some questioning he learned that we'd be eating that evening at the nearby Mexican restaurant. So... after dinner when we went to pay and leave, the waiter appears, plops a huge decorated sombrero on my head, and five restaurant people show up to present a small cake and candle and some Mexican birthday music. Another total surprise!

We'd decided to stay in Madras because I'd heard of the WWII aircraft museum, near the airport just north of town. It was an important and historic airport with a large and comprehensive collection of WWII-vintage planes. We toured the place, learned a lot, and found a plane that looked very much like the WWII trainer that provided my very first parachute jump in Red Bluff so many years ago. We then headed for Portland and Aaron's place for a few hours.

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We'd booked a place called Island Station in Milwaukie, right on the Willamette River. The Decatur team landed and met us at Island Station. Our tiny apartment was part of a larger home with a large yard abutting the Willamette – with kayaks, tubes, and water gear as well as a hot tub. The granddaughters had grown. We hadn't seen them for two years, due to the cancellation of year 2020! Sylvie was now taller than Barb. They used the provided water recreation gear for short adventures on the adjacent Willamette River. The vacant lot next door was loaded with ripe blackberries, which the kids avidly picked for birthday pies.

Then off we went to Susan's Cottage in Manzanita. The Mandas had booked a small home a few blocks away on Ocean Ave.

## Manzanita, Books, Yachats, and Echo Summit!

We had purchased some message T-shirts, which the girls kindly wore.

Josie's I especially liked:

*Go Ahead*

*Underestimate Me*

*That'll be Fun.*

Amalia's, honoring her chemistry interests, read:

*I Only Use*

*SArCaSm*

*Periodically;*

*The Universe is Made of*

*Protons, Neutrons*

*Electrons & Morons; and*

*Think Like a Proton:*

*Stay Positive.*

Aaron received  
S O C C E r  
*The Essential Element.*

Andrea and Tonio liked their  
*You Can't Scare Me.*  
*I Have Three*  
*Daughters.*

Proud mother Barb had brought several copies of Tonio's newly published *The Last Embassy*, 2021, to give to the extended family. It was dedicated to Josie:

"...whose enthusiasm brightens our lives."

His previous book, *The Gunpowder Age*, 2016, was dedicated to daughter #2, Sylvia:

"...who understands both sides with love."

And the one before that, *Lost Colony*, 2011, to Amalia:

"...who loves a good story."

His current book, due out in 2024, is on the Dutch East India Company.

We had Amalia's great pies for our birthday celebrations. Jill and Sylvia made a large paper mache piñata, which was destroyed the next day in the back yard. We, of course, hiked Neahkahnie Mountain. Then Tonio and team headed back to Portland, and home to Decatur the next day.

Barb and I routed South to Yachats, where we'd rented an incredible house named Rooms with a View, on the coast just south of Yachats. There were tide pools just outside the house with incredible views to the north and south. Aaron joined us a day later. Together we explored Yachats' unique Amanda Trail. We also did the Ya'Xaik Trail in some redwoods – practically in downtown Yachats – with a small once-private botanical garden. The Cummins Creek trail, just before Cape Perpetua, south of Yachats, was another destination and adventure. We decided then and there we liked Yachats and would like to move our Manzanita get-together to Yachats in 2022.

Barb and I headed south again to Brookings and then on to a motel just East of Eureka, arriving in the dark with some difficulty. The next morning we drove via 101 to Clear Lake to see brother Rhys Williams for two hours, then down to Cotati to see Manny, Barb Rossi, and Stephanie for just an hour or so.

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The trip home was interesting. We left Cotati a little late and got stuck in terrible traffic going around the North Bay to try to get on 1-80. Hours later, in Sacramento at dusk, we learned via warning signs that 1-80/Donner Pass was closed at night for road work. So we routed to US 50 to get over the Sierras. It got very dark, so Barb agreed to drive, even though it was freeway. She really did not want to drive on fast highways, and I have difficulty (perception, contrast, general vision) with night driving. But she drove.

We finally got up Echo Summit to South Tahoe with impatient vehicles passing on the narrow road in the blackness. We made it to Carson City, then up the short highway to Reno and Sparks, finally checking in very late. Exhausted. But she did it! We'd survived. Then the next day we drove all the way to SLC. We routed home via 3300 South and Mano Thai just before dark, getting take-out for our first dinner back at home. All was well.

We listened to audiobooks on the road, of course, and to broadcast radio when the reception was good. Talking about our history and memoir writing, we heard, or heard something which reminded us, of the song *Something Tells Me It Might be You*. Barb was driving on a stretch somewhere in the middle of Nevada, so I looked it up: by a Glenn Jones. Earlier we had joked about and enjoyed the Kitty Kallen song *Little Things Mean a Lot*, quoting it to each other at the opportune times.

In August we continued downsizing. I selected and shipped books on science and chemistry to Amalia. We sent her a chemistry-themed birthday parcel as she had told us how much she was enjoying studying chemistry.

I had been having issues with the keyboard on my tiny MacBook; cleaning didn't help. I had purchased it in 2016, just before our low weight baggage trip to Madeira. I could use it with an external keyboard, but that wasn't really convenient. Wanting to replace it, I learned Apple no longer sells such a tiny machine, probably because the unique 'butterfly' keyboard had many longevity problems. So I bought a MacAir, which weighs nearly a pound more, but is otherwise even more convenient. The geeks in the UU Bookstore transferred everything onto it for a modest fee; I was back in business.

## Vaccines and Jake Hanson

Jake Hanson and I met to restart and expand our website project. I was focusing on the permanence problem. How does the site survive after I'm gone? How is the 'legacy' protected and made available in the future?

We sat in our outdoor breezeway for the discussion. When we were nearly finished, as we hadn't been masking, I casually said something like,

"I assume you're fully vaccinated?"

Silence for a few seconds.

"Err, actually, No".

I actually jumped up, put on my mask, and spat out

"Why not?"

He slowly responded something about vaccine side effects, and young folks don't really need it.

"And what about us older folks?" I stammered, gesturing towards me, Barb, and the house.

He really didn't respond. So I continued...

"Shouldn't you have said something, knowing how old we are and how concerned we are about getting infected?"

He couldn't really respond adequately. I almost ended our association then and there.

I ushered him to the door:

"We'll talk later," I said, but continued:

"Before you enter anyone's home, tell them you're not vaccinated, because the assumption among most educated, informed people, is that of course you are."

Later he sent me a long email noting subjects like mass psychosis and concerns with government and big pharma information – and some links about vaccine side effects, and especially a long video interview of Robert Malone, an RNA vaccine skeptic. He did note:

"I'm helping my family and others I hold close who are at risk of a gene-therapy-induced compromised immune system..."

I listened to Malone and some of the other links. I responded:

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The first 2/3 or so of your message reflects ideas and perspectives we've been discussing and addressing for many years. Your Section 4 and 5 starts to get to our serious and, for me, disconcerting, discussion:

It's all about YOU – your risk, your understanding, your choices, your empowering 'stance' – classical libertarian philosophy.

I think you're smarter, more empathetic, even compassionate, than that.

Risks vary greatly. You were entering the home and refuge of a couple who, although quite healthy, are in a high risk group.

As a visitor and friend, don't you have some concern, perhaps even responsibility, for the risks you present to them?

Shouldn't you arrive masked, expressing distance and other risk concerns, until you assess their situation and comfort level?

Is it their responsibility to have signs on the door? Shouldn't you ask? Were you aware? Concerned at all?

When you know more about spike protein issues or auto-immune side effects, let me know.

I didn't convince him – and he didn't convince me. After a few weeks we set the matter aside and continued working together, remotely. I kept paying him a monthly stipend; he was generally available for posting content, site updating, and working on the permanence aspects of the site.

## Socorro and Lucero

Barb and I had this small box of personal materials given to us for safe keeping by Socorro Ortega, back in 1975 (Chapter 5). We started asking if Socorro might still be alive – she would be about our age. We assumed Lucero would likely be alive, of course. The box contained some documents, momentos, a baby shoe, and some photos. We'd been saving it for 44 years. We examined it. The shoe reminded me of the one line story attributed to Hemingway:

'For Sale: baby shoes, never worn.'

What was Soco's story? We had a few photos from the mid-70s of Soco, and new baby Lucero. We even had photos of father/boyfriend Gerhart Henshel, who had thrown them out in 1977.

Where were they? Were they in Mexico? Did they want their white box?

So, in Sept., 2021, we showed the box to Barb's close friend, Fanny Guadeloupe Blauer, and to several other friends with close connections to Mexico. We also connected with Mariela Taddei, who was Socorro's friend and companion when Lucero was born, back in 1977. Mariela and husband, Larry, were also very interested. They hadn't heard from her in the past 44 years. No contact.

Fanny is a dynamic, problem-solver:

"Maybe she's on Facebook!"

Another close Latina friend, Miriam Garcia, had her mother, Carmen, in town. She was intrigued. So we had a small get together with Fanny, Carmen, and Lallo, a close friend of the Amigas Latinas book group. We opened the box, examined the documents and artifacts, including Lucero's baby picture and baby shoes. Everyone was very curious and interested.

Lucero was indeed on Facebook, with some pictures, now some 44 years old! Soco's now entering her 80s, as are we.

A few days later, Sept. 7, we met again, this time with Mariela and Larry Taddei, whom we hadn't seen in decades. Mariela helped Socorro back in 1975 when she was pregnant – Lucero and Socorro stayed with the Taddei's some weeks before Soco got her own apartment. We tried to track down Soco and Lucero – on Facebook and on What's App, which had become a very effective international communications program. It only took 30 minutes or so. Seconds later a message went out, via What's App, to Lucero, asking, in Spanish, something like:

"Are you the Lucero born of Socorro Ortega in Salt Lake City in 1975?"

And, perhaps ten minutes later, Lucero responded:

"Yes, I am... We can't talk now – there are too many tears!"

We burst into ecstatic applause, drank a bit more Tequila, waited for some time, and then received another message. It was Socorro calling! She and Mariela talked, then Barb. Everyone was so pleased.

On a later trip to Mexico City, Fanny met Socorro and Lucero, who fortunately were there for other reasons. Lucero gave Fanny the name of a friend of

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Lucero's now deceased father, Gerhart Henshel. Fanny contacted the friend when she was back in SLC, obtaining a small box from him of Gerhart's artifacts and documents. Fanny will give the materials to Lucero when she's back in Mexico City for her mother's 80th birthday, in Dec. 2022.

Cool story.

## Late 2021

Aaron and Laura arrived in his Prius in mid-October. We headed out, in our Prius (with fewer miles and better tires) to see Capitol Reef for several days, between storms. We had very good weather – lucky!

I'd been reading Michael Pollan's *This is Your Mind on Plants*, 2021, focused on opium, caffeine, and mescaline. I focused on opium. It was quite liberating to learn that I could easily brew an opium tea from common California poppies. I understood that if and when my pain got very bad, it could probably be alleviated by strong opium teas. I planned to experiment. In summer, 2022 I would harvest our own poppy pods.

Writing continued. I was recollecting and researching the Kolff-instigated trip to Mississippi which resulted in our inebriated team's outline of a Kolff biography we called *Balls: The Story of Pim Kolff*. I wanted to talk with Tom Kessler, one of the team (the only one not inebriated). I called Bert Bunnell, his former employer, to get Tom's number. Tom was happy and eager to talk about his memories of nearly 50 years ago. He had many clear memories of the trip and thoughts on Jarvik and Owens (covered briefly back in Chapter 4).

Coincidentally with those Jarvik recollections, Rob Jarvik's ex-, Elaine, invited us to her 50 Years in Utah 'celebration' on Oct. 31. She and Rob had rolled into SLC on that date in 1971, staying at the Alta Motor Lodge, 1899 So State St. We met in the Lodge's parking lot, had drinks and cookies, Elaine read a short essay she'd written for the occasion. Lodge clients looked on with amusement, as did the proprietor. The Lodge was still there, not greatly changed in the past 50 years!



In November Jake implemented my legacy site into the Internet Archive via its Wayback Machine. It seemed to work fairly well.

In mid-November Lee and Sally Smith invited us and John and Françoise Hibbs to dinner at Smith's home on Sunnyside Ave, just below the Hogle Zoo. It was great to see them again. Lee was one of my early graduate students; he'd worked in John's vA lab during his PhD. work. Both Barb and Françoise were supporters and customers of Sally's unique book shoppe – A Woman's Place. At this gathering I learned a bit more about Pim and Yanke via Sally's recollections. I covered this somewhat in Chapter 7 on the later 80s.

A few days later, we were off again to...

## Pacific Grove, via Aرسالans

We bunked in St. George and hiked the short Johnson Canyon trail in Snow Canyon State Park.

Then to Barstow for the next night. On to the Aرسالans for several hours, and a phenomenal lunch, then on to Carpenteria for the night. We enjoyed the Aرسالan girls, Ahmad's flute prowess, and Nadia's keyboard and singing skills. We learned she is a fan of Olivia Rodrigo.

We saw Bert and Kate Bunnell in Pismo Beach. They spend winters there. Bert is an acquaintance from my bioengineering days. His company, Bunnell Medical, produced high frequency oxygenators used in very pre-term babies. Some of the original Kolff people ended up working at Bunnell Medical, including Tom Kessler, David Malm, and Jeff Orth. Bert also provided some funding for The Leonardo.

We met them at their condo just above US 101, went to a nearby restaurant for brunch, discussed our mutual back pain issues. I shared my pain regimen with him (Tylenol, CBD, a bit of THC). Then we went up and on to Pacific Grove and the Casa Simpatica cottage.

I learned of a workshop on Engineering Undergraduate Education, and was very impressed by the people speaking, including a University President and a Dean of Engineering. It focused on a more open, societally concerned,

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project-based approach. I thought the UTU Department Chairs and Dean should know about it. That might be considered critical and arrogant on my part, because as educators and teachers they should of course know and be interested.

But, decades of experience have taught me that most professionals are very ignorant of many issues and activities which, in my opinion, are very relevant to their own work and to their students. So it's my job to try to enhance their awareness and knowledge. I even sent the announcement to the Dean for Undergraduate Studies and several others who should know of and be interested in the subject. There was absolutely no response. I even sent a reminder just before the event. Nothing. I shouldn't have been surprised or annoyed: they didn't listen when I served as Dean, why might they care what an ex-Dean might suggest?

Many months ago Carol introduced Barb to the Essential Stretch or Essentrics programs by Miranda Esmonde-White. They were broadcast on our local Utah Education Network (UEN) Channel 9, as well as early on Sundays on the PBS affiliate Channel 7-4. We enjoyed the various stretch and related exercises. Miranda was focused on pain alleviation, including lower back and spine issues. Barb and I found the sessions refreshing, healthy, and invigorating.

On December 8 Manny was driving to Redding to work on his property, was impatient, passed a car where he shouldn't, and rolled into and over in a ravine, totaling the truck. He was lucky to be alive, surviving with hardly a scratch. We of course helped him purchase a replacement vehicle, this time an SUV style Jeep rather than a truck.

In mid December Jai and Brinda Jaikumar visited us with their kids, Addi and Anjali, and Jai's parents from India. Jai and I had worked together with The Leonardo (Chapter 10). We had lunch together and simply enjoyed talking. His brother or cousin was also present – he works in the tech sector in the Bay Area.

Aaron reluctantly did not come to Pacific Grove this year. He was concerned with air travel and his carbon footprint. Tonio and the girls did come, arriving Dec. 27 and staying near the kids' park – in a large home called The Caledonia. It was just two or so blocks from our Casa. We entered the house, checked out the newly remodeled kitchen, opened drawers and cabinets to see what was available.

Amalia reached up to open a kitchen cabinet and BANG! – the door came off and hit her on the upper forehead. It hurt, bled, and presented a problem. Tonio immediately left with Amalia to find an InstaCare or related medical facility. They returned an hour or so later. Amalia was fine – no scar or malformity. We

ate, talked, played games, and watched films, including *Encanto* – and learned ‘What is wrong with Bruno?’! We explored the Carmel Meadows trail, including rock climbing on the coast near the trailhead. They all left on Jan. 2.

The day they left I was not feeling well. I got worse with chills, general malaise, and intense urgent needs to urinate. That evening Barb took me to CHOMPS ER. After several hours of waiting and several tests, I was diagnosed with UTI (Urinary Tract Infection), given antibiotics, and put on a pill antibiotic regimen for the next 10 days. I was told to drink more water!

Sasha Hattori visited again in her cool Miyata. We talked, walked, sampled her home-made prune/apricot liquor. And I kept researching, remembering, and writing.

The urgency and related symptoms came back intensely several weeks later; we again visited the same ER on Jan. 24. Same issue and situation. Same pills, but this time including one to minimize the Urgency. I was told to visit my doctor and a urologist as my tendency to get UTI is enhanced by an enlarged prostate. I drank still more water, and called the SLC doc for an appointment upon our return.

On Jan. 26 I drove to Fremont to see Stephanie and Manny. We talked about financial help, health and longevity for Barb and me, the indefinite future, and mortality. We also discussed their medical conditions and issues. I increased their monthly stipend, making it clear that there would be no special allocations or gifts – they each had to be most prudent and resourceful financially. They have each had rough and difficult lives.

In early 2020 or late 2019 Steph acquired a severe eye infection, initially untreated, perhaps related to COVID hesitations. Her vision rapidly deteriorated. After much discussion with her Kaiser health care ophthalmologist she opted for a corneal transplant, which was done just before the 2020 California wildfire season exploded, showering much of California, and especially the Bay Area, with intense smoke and polluted air. That compromised the transplant. After more interventions, and wearing a patch in late 2022, her eye was sewn shut – a forced rest and protection to encourage healing. Maybe. It will likely not tolerate an additional transplant. Left eye vision now fully gone, after having been better in early 2022. She was devastated. Her right eye is stable but has compromised vision, to which she must accommodate. It’s a very difficult situation.

## Time Warp

Jan. 25th was Barb's big 80th! It was just the two of us – we sort of combined the birthday and our 56th wedding anniversary celebration. We booked a room for Feb. 4 at the Tickle Pink Inn (really!) in Carmel Highlands. It was recommended by Beth, Barb's walking friend in PG. The Inn was perched right above Highway 1 with spectacular views to the North and South. A pleasant splurge.

I write this from our room at Tickle Pink Inn – with an incredible view of the northern Big Sur coast. The balcony view to the North includes Bird Island, the southern-most point of the Point Lobos trails. A most beautiful place. The Cosmos, the stars, looking west from our balcony, were absolutely spectacular early the evening of Feb. 1. Incredible. Then a walk on the coastal trail in Carmel Meadows and then the Mission Trail in Carmel, which sort of parallels Highway 1.

Barb and I were recalling that incredible 'wedding' day 56 years ago. I recalled it earlier in these pages, and read a few paragraphs to her. This was the first time that she'd directly seen or heard any of this draft memoir. We laughed and recalled, and gently corrected each other's memories and perceptions.

We tried to book Casa again for next winter, but rates had increased. So we settled for a place on 10th St., larger, cheaper. We left PG on Feb. 6 down 101 to Ventura, where we stayed the night. We saw the Aarsalans again on the way to Barstow. Then it was on to St. George and further on to SLC.

In North Las Vegas, right off I-15 we had an interesting situation with a young woman who claimed we had hit/touched her car at an intersection. She followed us to the nearby gas station where we were filling up and confronted me. I examined her car, examined ours, concluded there had been no contact – and certainly no damage. She was unconvinced. We didn't exchange any information; she didn't ask to, and Barb and I were both sure there had been no contact. We went back to I-15 and rolled on. We were listening to Stacey Abrams' novel *While Justice Sleeps*. We'd found it in the PG Library, so I transferred it to mp3 CDs to listen in the car. It was a very good selection for the long, often dull, drive. Back to SLC and our home on Feb. 10. All ok.

We were now well into 2022, the third year of the COVID-19 pandemic. The vaccines have helped, but the vax-deniers and anti-vaxxers had made a bad

situation continue to stay bad. Rather than getting COVID fully under control, it was clear the danger was still high. We chose to continue to mask and exercise much caution.

## SW Kim Tribute, and more

Feb. 22–24, 2022 the College of Pharmacy hosted A Tribute to the Late sw Kim: The 18th International Symposium on Recent Advances in Drug Delivery Systems. I attended the evening reception on Feb. 23. There I found Jim Anderson (whom I hadn't seen in decades!), as well as many former collaborators and friends. I saw David Lentz, who I thought was part of that 1975 trip to Mississippi, but he assured me it was not him. I recalled his son Matt, who worked on several The Leo exhibits while a BioE undergraduate. We all said our goodbyes to Sung Wan, and condolences to his family.

The crazy lady in Las Vegas filed some 'collision' report with Las Vegas Police! We received a letter of inquiry. Our insurance (Farmers) had received one earlier from State Farm, her insurance. I clarified the situation with Farmers and with the LV Police person, including sending photos of the Prius. So far, that's was the last we heard about the non-incident.

The Leonardo awarded the da Vinci Prize the day before Leonardo's birthday, April 14, 2022, to Nalini Nadkarni. Nalini gave a phenomenal talk, which I fully recorded: <https://www.dropbox.com/s/vn1e11288oj6849/Nadkarni%20Leonardo%20Award%204-14-2022.MOV?dl=0>

She answered questions and had several tables displaying her projects, activities, and book. It turned out to be a very good event, although sparsely attended.

In May I came across a discussion between Tim DeChristopher and Wendell Berry, titled 'To Live and Love with a Dying World'. It was in Summer, 2019 and was published in *Orion* magazine. It was fascinating and sad for me. My summary take on their discussion was that they simply live and think in two very different worlds:

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Berry has made peace or accommodation with his concerns and situation on the planet. He is not (or is no longer) trying to save the world. He is trying to live sustainably, responsibly, authentically. The world – or humanity – will just have to save itself.

DeChristopher is a caring, responsible activist who would indeed like to help the world save itself – but he doesn't know how. He's acted individually and responsibly to draw attention to what individuals can do – and tried to empower them to act perhaps similarly.

Two important, accomplished, impressive people, different generations, different approaches, many of the same concerns.

Interesting.

Aaron and his Prius came out for Mother's Day – to help with our downsizing efforts and to encourage us to move ahead with modifying the downstairs bedroom so we could accommodate a live in caretaker if and when that becomes advisable. We discussed possibilities for an adequate fire escape basement window. I had talked with a local architect and with David Blauer about some ideas.

Our Mother's Day festivities included Hladys, Shahpar and Elaine Jarvik. Tonio and Aaron talked us into subscribing to Google Fiber which was now being installed in our area. We did.

When we turned the lawn watering system on later in May, we had a small geiser in our west yard. The Google boys had lightly sliced into an underground plastic pipe. It was repaired by Danny Blauer. I asked Danny to produce an invoice for me to present to Google – Danny Boy's Maintenance was thus born! Google reimbursed me for the damage and repair. And Google Fiber has been great. To help use some of that new bandwidth, I acquired a large LG monitor for my use downstairs. Tonio had been planning his own downsize encouragement visit and would need to work somewhat while here. Google Fiber and a large monitor would make that easier for him.

Barb also wanted a 'proper' 80th birthday party. So we organized a *Pachanga* (Party) on May 28. Tonio was here at that time, on his way home from a lecture gig in Southern California. I set up an outdoor sound system and cordless microphone. The weather cooperated. We were all outside and thus somewhat COVID 'safe'. Lots of dancing. Blauers brought their wig collection, which we all used.

Tonio got us on to the Jordan River Parkway trail system the next day, and we had an outdoor Pictionary session with Blauers, Tonio, and his old friend Jonathan. Then it was just Barb and me for a while. Later in June, coinciding with the Utah Arts Festival, Karen Sweeney came for a few days. We ate, talked, strolled the Arts Festival.

In early July we contacted Marissa's Books, a nearby large bookstore, which Aaron and I had visited a few weeks earlier together. We were impressed with the scope and size of Marissa's, asked about giving books: they were interested! The first of five SUV/vanloads of boxes of our books went to Marissa's. We emptied much of our basement, removed several large bookshelves, continuing our downsizing.

Puppy and I met our urologist in early July. We paid close attention – two drugs, with decreased 'libido' side effect, 'perhaps retrograde ejaculation', ... We return to Doc Urologist in February, 2023 to continue the discussion.

## From Malheur to Yachats

We headed for the Oregon coast in early July, via Denio. We drove into very quiet Denio on a Sunday, checked out the post office and the Library, to which we'd donated some dollars a year earlier. We continued North on 205, with Steens Mountain Wilderness on our right, through part of the Malheur Wildlife Refuge, and on to Burns. When we got to Burns, the front of the car was coated with insects. Funny, we didn't see many on the windows or in the air as we were driving. They must all have been near ground level. The Best Western in Burns was very pleasant. We had a studio apartment for the price of a normal small room! Then it was on to Bend, Madras, and up Highway 26 into Portland, arriving at Jill's house in NE Portland. We rented her neighbor Amy's house there for a few days. We 'moved in'.

The next day we visited Mandas and later went to downtown Portland for Aaron's gig with his VCR band; Paul was there, setting up to film the performance. Hot but well worth it. Then it was back to Jill's and Amy's place to await Tonio and the girls, who had just landed. We dined in Jill's back yard with

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corn crust pizzas – delicious. The next day, my birthday, we were off to Yachats to Beachy 101, a large home we'd rented. The Mandas showed up several days later to another home we'd rented nearby, July 15–19. Aaron stayed in the Yachats Inn and the Dublin House Motel. The Beachy house had an upstairs bar and lots of room – and a functioning hot tub. We set up our portable ping-pong table and just enjoyed Yachats and the surrounding area. Amalia baked her pies to help celebrate my birthday. We ate dinner at the Manda's house – it had a better large dinner table. Jill and Scott stayed in the Manda's house.

We did the Yachats area hikes as well as Cape Perpetua and the walks there. We (or rather I) looked at two houses for sale in Yachats. One was a duplex right downtown and adjacent to Yachats State Recreation Area. The owner was planning a trip to Portugal – to Madeira. We talked. I later sent her several of our hiking guides to Madeira. But we didn't buy any property.

I'm still interested; Barb is not.

The girls discovered the local rock shop and made some purchases and attended a workshop. Aaron set up his keyboard; there was some jamming. Amalia brought out her trumpet and also played a bit. We played white board Pictionary, talked, and simply enjoyed. It was all over on July 21. The Mandas had left two days earlier. Tonio and girls – and Aaron – headed to Portland and home. We headed south, then leaving the Coast for 1-5, then down to Ashland, and East to Lakeview, stayed at the Fremont Inn, and left early for Denio Junction, Winnemucca, and on to SLC. Home! Another long drive.

## Local Socializing

In late August Ian and Hilda Feijen made a visit to SLC to visit Sung Wan Kim's family and pay their respects to the high desert around Ely, Nevada, and the railroad museum there. Dave and Holly Grainger hosted them, us, and Phil and Wylie Triolo at their Avenues home for dinner and discussions. Grainger and Triolo, both students of Kim, had each worked in Feijen's Lab in Enschede, The Netherlands. Shortly after arriving in Enschede, Phil met Wylie, they clicked,



and were soon married. It was a historic, nostalgic, and fun outdoor and COVID-conscious evening.

We had two Latina gatherings in September, including Tessa Epstein's 77th birthday. Barb and Tessa are two gringas with honorary Latina credentials! Danny Blauer and I worked on our bridge, which was overdue for sanding, staining, and sealing. Grueling – but probably good for five years. We learned of Amalia's new Special Projects course – she is doing it on the energy-climate situation. I shipped her some of my energy workshop demos and sources. She received a unique but a bit strange 16th birthday (Sept. 3) present from us: the magnificent Colombian machete Barb gave me when we were married back in 1966 – which we used several times in dancing Colombian Cumbia. Amalia has liked costume dress up events, so maybe she'll actually use it.

We received the new multi-valent COVID booster vaccine in October – and current flu shots for older folks several weeks later

And then the November 8 election, which fully played out after the Georgia Senate runoff in December – Biden and Warnock won!

## Easements and Compost

We've gotten interested in environmentally responsible 'burials' or funerals. There's a lot of interest now in dead body composting. In fact, our estate lawyer, Natalie Segall, is also very interested, having just written a Utah Law Review paper on the subject.

One idea is to design our own compost burial – perhaps in our own backyard. If we die near or on our own property, then the logistics are simple and the environmental impact minimal – perhaps even positive! If we croak somewhere else – in the USA – then getting the dead body to our backyard shouldn't be very expensive or environmentally negligent – just get someone to drive our bodies in our car to our backyard. I expect to have the hole pre-dug and a small sign or plaque in place, with perhaps a tree or two planted on or near the new rich compost-to-be. Barb still prefers to be deposited in Sonoma County.

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We intend to put a conservation easement on our property at 949 MillCreek Way, perhaps to be managed by the Seven Canyons Trust. On June 3 we visited the Three Creeks Confluence, and walked the adjacent Jordan River Parkway. The Confluence was one of their Trust projects. Our Easement would include our land which borders Mill Creek, the bridge over the creek, and the property on the North side of the creek. The house and property South of the creek would continue to be occupiable and maintained, but not allow for any home footprint expansion.

We have continued talking about mortality, ‘departure’, and associated topics. The north side of the property could be noted as – or even declared to be – a human remains composting site. It would be accessible on foot via the creekside trail, an objective of the Seven Canyons Trust, or via access from Mill Creek Way – along the West side of the house. There should be a small sign on Mill Creek Way noting the foot path to the bridge and the composting site.

Seven Canyons Trust has discussed these plans as a pilot project and is moving ahead. We’ll continue to encourage their efforts as well as to encourage the state to more formally legalize, if not encourage, human composting. We plan to continue living for a while.

Another ‘burial’ option is with the uu School of Medicine Body Donor Program. I think my corpse would be very interesting for human anatomy (and pathology) education: artificial right hip, L3-L5 fusion, intraocular lenses. I’ll be signing up.

## Thanksgiving, Qatar, Bye to 2022, Next...

We’re on the road again on Thanksgiving Day, heading for sleep and rest in Barstow, good friends and food in north LA with the Aarsalans, then to Pacific Grove directly via I-5.

We watched the Qatar World Cup soccer matches. I recalled how effective the 2018 World Cup, especially Croatia, was to my pain distraction strategy.

Although I'm in much less pain now, thanks to the Tylenol and CBD/THC regimen, Croatia was again a major distraction and entertainment. We rooted for Argentina rather than France – it was a great game, as was the Croatia – Morocco game for third place. Barb and Aaron were constantly texting – as were Barb and Milena Hlady during the Croatia games.

Aaron arrived on Dec. 21. Tonio, Andrea and the three girls arrived Dec. 27. We had a great time, and rang in 2023 together, with some optimism.

Removal started to become a key focus – a planned sequel to *State Change*. The basic idea was – if I couldn't manage to change their minds, maybe I could simply plan to remove their minds – by permanently removing them. It seemed/seems reasonable to me. I did want to finish this memoir through 2022, and then, if still alive, focus on *Removal*. That's the plan – and the next project.

On to 2023 – and hopefully beyond...



## Into our 80s

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Harold Dunn, Hip Fixer • Sept. 24, 2022: Utah in the New York Times •  
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After Putin?*

## Introduction

**T**HIS NEAR FINAL chapter continues my ongoing observations and perceptions. Although this memoir ends with the end of 2022, I will continue to write as long as I am able to and interested in doing so, perhaps even as my own 'fog' begins to descend.

## April 25, 2022: Orrin Hatch

Utah Senator Orrin Hatch died April 23, 2022. I read his full page *New York Times* obituary today, April 25. If I hadn't interacted with him and known him a bit, I'd have been very impressed. The *Times* obit didn't talk about his arrogance, patriarchy, and stuffy nature. The obit did note that colleagues considered him 'humorless'. It also noted that he ran a band in his pre-Senate years called Free Agency; it also mentioned his many conflicts of interest and some of his many hypocrisies.

'Free Agency' was new to me. It's likely a take on the Mormon idea of 'agency' – you are free to think and act for yourself – you can 'choose the right'. That is as long as the 'right' falls within the Mormon canon and the patriarchal confines of The Church. You're only as 'free' as your bishop or father says you are.

He wasn't racist, but he was a misogynist. His actions towards Anita Hill during the Clarence Thomas hearings were a travesty. He opposed the Equal Rights Amendment and opposed women's rights to abortion. And then later he hosted his Senator Hatch's Conference for Women in Salt Lake City! The height of hypocrisy.

He did help when I served as Dean of Engineering in facilitating the admission of Henry and Pavla Kopecek to the USA in the late 80s, during the end of my tenure as Dean.

But the action I remember most vividly was a meeting in UTU President Chase Peterson's office. I was a very new and quite young Dean of Engineering, representing my College. I think the chairs of Computer Science and Electrical Engineering were also present, together with Hatch, Pres. Peterson, and other members of the 'higher' administration. We were touting the strengths and advantages of the UTU to reps from a major telecommunications firm; they were planning to build a large R and D facility, perhaps in Denver or Salt Lake City. Hatch was a relatively young, newly elected Senator, with obvious aspirations of great power and influence. Several of us were literally embarrassed by his demeanor, swagger, and influence peddling during the meeting. He practically threatened them if they chose to not site the facility in Utah.

His arrogance was only exceeded by his ignorance. They chose Denver. None of this is in the NYT obituary!

The worst thing he did was to unseat one of Utah's most reasonable senators in 1976: Frank E Moss.

## June 24, 2022: On the Bus...

On the bus to 'work' this morning, an elderly couple boarded, each in their own powered wheelchairs. They were quite handicapped, had some modest difficulty controlling and navigating the chairs into position. They were in great spirits, smiling, trying to communicate via their highly distorted voices. I was two rows behind. They were placed in the front – parallel to each other. They'd look over at each other, smile, and talk – each in his/her uniquely distorted voice – in great spirits, calm, in control. It brought a smile to my face and tears to my eyes. They were alive! They had each other. In good spirits, they were on an outing to downtown. I got off long before downtown, but they certainly made my day – and their own day. Beautiful.

I walked up to Café Noir, at 2nd South and 1000 East, to get lunch provisions and coffee for my midday writing in the Law School foyer – a quiet, open, calm place to work and write.

Café Noir was where the early work on *State Change* began to materialize. A few blocks north, on Second Ave., is Cucina, where Hugh (alias Bill) and I met many times to discuss the evolving *State Change* project – and many other topics. And continue to meet semi-regularly.

Karen Sweeney should be landing in a few minutes. Barb will pick her up at the TRAX line Central Station. We haven't seen her since we were neighbors for a week or two in the Pacific Grove townhouses – in early 2018. It was around Feb. 1, 2018 when my back went out – some four years ago – and we talked with her and son, Craig, about pain, CBD, and THC. We haven't seen her since then.

## June 26, 2022: James Lovelock died today

On his 103rd birthday! I never met him or Lynn Margulis, who died in 2011 at the age of 73. They were each identified as one of my heroes in *Science without Walls* (swow) and in many of my talks and lectures. They found each other and worked closely to bring their complementary, creative, and prescient ideas to the attention of the scientific and public communities. According to Timothy Lenton in Lovelock's *Science* obituary:

'Lynn Margulis put microbiological flesh on the chemical bones of [Lovelock's] *Gaia*.'

Lenton also refers to Lovelock's 'signature breakneck speed, and... wicked sense of humor.'

Chapter 35 in swow is Planetary Medicine – and planetary pathology, of course. The presentation was based on Lovelock's very creative and prescient *Gaia: The Practical Science of Planetary Medicine*, as well as on his first two *Gaia* books, subtitled *A New Look at Life on Earth*, and *The Ages of Gaia – A Biography of our Living Earth*. As recalled earlier, I discovered and acquired Lovelock's memoir, *Homage to Gaia: The Life of an Independent Scientist*, in the gift shop of the Center for Alternative Technology in Wales during a visit on 2-7-2002. As I get older I appreciate more and more his words:

"Of all the prizes that come from surviving more than fifty years, the best is the freedom to be eccentric. What a joy to be able to explore the physical and mental bounds of existence in safety and comfort, without bothering whether I look or sound foolish. The young usually find the constraints of convention too heavy to escape... The middle-aged have not time to spare from the conservative business of living. Only the old can happily make fools of themselves."

Although he always seemed optimistic and upbeat, he must have died very disappointed that mankind could not work together to address the planetary pathology that men – mainly men – have created. He once said,

"I would sooner expect a goat to succeed as a gardener as expect humans to become stewards of the Earth."

He always capitalized Earth.



Through ignorance, arrogance, apathy, and capitalism-driven evil, mankind appears to be driven to its own extinction. Lovelock certainly tried to teach us, wake us, and empower us to act. We have failed him – and perhaps mankind itself. The Planet will survive, of course. Human-like life will likely get another chance to develop a sustainable civilization on our greatly altered and challenged planet. Perhaps.

## **July 8, 2022: Puppy and I met my urologist today**

Today we had our first visit to a urologist, Doc Summers at uu – good teacher. Puppy and I listened intently, learned a lot, and broadened our perspectives and plans. Our 80 year old prostate is OK, albeit somewhat enlarged, compromising urine flow. The Flomax drug, a muscle relaxant, has helped keep the channel open, but perhaps results in some retrograde ejaculation. That got Puppy's attention! I think I have noticed less spurt a few times, in spite of what seemed to be good ejaculation. Interesting. This has to do with the anatomic location of the ejaculatory ducts into the urethra, Dr. Urologist explained, and showed via a rough sketch. He says there's no harm in that – the urine will mix and it'll all flow out. Hhmmm. I'm already planning a drug strategy to perhaps minimize it – no Flomax for two days prior to a 'planned' ejaculation. Too much detail for you, dear reader?

I'll see him again in 6 or so months; more to experience and learn. The physics of ejaculation?

## **July 19, 2022: Ann Shulgin**

Ann Shulgin's obit appeared today – she died July 9. She greatly aided, expanded, and supported her husband's work on neuroactive drugs. She

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encouraged him to write, with her, the books which today provide the basic foundation for work on psychedelics – and on MDMA.

When I bought the books back in December 2014 to prepare for the writing of *State Change* (which I dedicated to Alexander Shulgin), they were still considered somewhat clandestine, possibly illegal – of drug cult interest.

The first of the several volumes, *PIHKAL* (*Phenethylamines I Have Known and Loved*), is subtitled *A Chemical Love Story*, hence my subtitle for *State Change* was *A Chemical Fantasy*.

*PIHKAL*, 1992, is a fascinating book. The first half (Part I – The Love Story) consists of alternating chapters by Alexander and by Ann Shulgin, beginning with their first meeting and discussions, their ‘courtship’, many trips, marriage, and partnership in making the remarkable trove of information available to the general public. It’s been called a ‘fictionalized autobiography’. The second part (The Chemical Story) is an encyclopedia of nearly 200 phenethylamine compounds of various neuroactive characteristics, including means of synthesis and assessment. The entry for MDMA formed the chemical foundation for *State Change*.

I did not know Ann Shulgin, but did hear her speak and met her for a few minutes at Psychedelic Science 2017, a conference in Oakland, Ca. organized by MAPS – the Multidisciplinary Association for Psychedelic Studies. I presented her with one of only 40 printed copies of *State Change*, noting its dedication to Alexander Shulgin. She graciously accepted it with some evident curiosity. I hope she appreciated and was perhaps amused by it. I also gave Rick Doblin, organizer of the conference and founder of MAPS, a copy. I assume he at least looked at it. I also gave a copy to his British counterpart, Amanda Feilding, founder of the Beckley Foundation.

## August 24, 2022: Robinson's *The Future*

Barb and I are reading Kim Stanley Robinson's *The Ministry for the Future*. Although not very well written, it is current, largely factual, comprehensive, and creative – and now just barely fiction. Much of what I'd been plotting for *Removal* is in it. We are now referring our friends to Robinson's *The Ministry* ... as one recent overarching, all encompassing overview of the nature of our planetary challenges – complexity, uncertainty, perceptions, and perhaps actions. We make it clear that the entire economic – sociopolitical system must be transformed, that we must indeed have a Plan B to achieve a new sustainable civilization – a new State B. Robinson's 'novel' employs the tools of targeted assassination, sabotage, and targeted 'terrorism' to provide the revelations needed to begin the transformation. I suggest we need to do the same.

Reality is playing out faster than the 'fiction' can be written and published!

## Sept. 17, 2022: Harold Dunn, Hip Fixer

A tall, white-haired serious man at Harmon's local grocery – I sort of recognized him. He recognized me.

"Hal Dunn," as he offered his hand. "How are you?" He introduced his wife – Kate, I think.

"Very good," I smiled. "Thanks to 25 years ago," I continued, gesturing over my right hip.

"That long, eh? Any issues?"

"Not really. I've put a lot of miles on it with no problems, until a few years ago.

Back went out – back surgery.

You still ranching up North?"

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“Yep.” And proceeded to tell me of a mutual colleague some 25 years ago, still living in Switzerland.

“Had it x-rayed recently?”

“Sort of. I ask my back surgeon, Doc Spina, to include the right hip in my followup x-rays.

There’s now some noticeable asymmetric wear – after 23 years.”

“That’s really good. That was back in 98 or 99, before the more wear-resistant material became available.”

“So far, so good,” I said. “You look really super.”

“Well, thanks,” he said. “So do you.”

And with that we said goodbyes, and continued with our Saturday morning shopping.

## Sept. 24, 2022: Utah in the *New York Times*

The *New York Times* (NYT) has been a regular input to my awareness, education, and development – for the last 50 or so years. It was somewhat irregular before that. I recommend that all kids be introduced to quality news and features in middle school and encouraged and empowered to continue to read and process the NYT and other quality sources for the rest of their lives. *New Scientist*, *Economist*, the *New Yorker*, *The Atlantic*, *The Guardian* should be regular reading for all residents of the planet.

Our friends and colleagues would always be entertained whenever Utah rated a mention in the NYT. I think the 2002 Winter Olympics put a positive spin on Utah’s media relations twenty years ago. We became mountains, snow, red rock canyons, national parks, hi tech, and the University of Utah. Those topics added to the media’s historical interests in polygamy, multi-level (Ponzi scheme) marketing, penny stocks, frauds and cons, cold fusion, very bad air, and a Mormon Church-dominated GOP state government – a theocracy. As far as

national media were concerned, Utah was always unique, different, and often wierd.

Today's NYT discusses a subject near and dear to my heart and brain: the TRIGA Mark I General Atomics 100-kilowatt, water cooled 'toy' reactor in the SW corner of the Merrill Engineering Building (MEB) at the UU. It certainly isn't a toy – it's a real, functioning, nuclear reactor for education, teaching, and awareness purposes. 100-kw means it generates about as much energy as 30 to 40 normal homes with roof-mounted solar panel collectors (photovoltaic array).

I assume that the entrance requirements for Bioengineering at the UU have deteriorated – because today's NYT reported that a UU BioE senior noted on a trash social media site:

'If we don't win today, I'm detonating the nuclear reactor on campus.'

That inane (likely innocent) terrorism threat resulted (appropriately so) in her arrest, and garnered otherwise important space in the NYT – and of course PR for Utah and its University. Governor Cox and President Randal were likely delighted.

I became nostalgic.

Back in 1983, the then head and likely only person on the faculty in nuclear engineering, Gary Sandquist, introduced me to the UU reactor, and the teaching lab adjacent to it. I was soon to be appointed Dean of Engineering. My office was to be – and became – the SE corner of MEB, one floor above and nearly directly over Sandquist's 'toy' but real reactor. My longevity documents that I suffered no long term physical risks from working one floor above a real, operating, tiny nuclear reactor.

As I learned more about the various departments and programs in 'my' College, I quickly realized that demand for nuclear engineering was not very positive. This was about four years after the Three Mile Island nuclear power plant incident near Harrisburg, PA. which depressed interest in nuclear power. Unit 2 of the San Onofre (CA) power reactor was to go online in the next few months. There was considerable discussion of nuclear safety and risk at the time.

And my College desperately needed space... So...

I seriously considered shutting down the reactor, removing it, and garnering much needed space. Sandquist and his mechanical engineering colleagues were livid, as were others. The UU Office of Radiological Health was very

concerned – so was the higher administration. Most of the public and state government had no idea we had ‘nuclear’ on the campus.

I did do some serious homework, learning that fully closing an active reactor was difficult, expensive, and time-consuming. And removing it and ‘filling in its hole’ was an even worse problem. So prudence prevailed. The reactor continues to operate, and Nuclear Engineering continues to exist. The Dean’s Office has been relocated to another building – for reasons having nothing to do with ‘nuclear’. The whole incident punctuated my requests for new space.

Never in my wildest imagination had I perceived it as a terrorist threat.

## Oct. 4, 2022: NYT Front Page – Organic Chem professor fired

NYU fired an experienced, well known organic chem prof. for teaching a ‘too hard’ course and giving a high percentage of low grades, complicating life for students who need good grades to get into medical school.

Organic chem is a foundation course for medical school. You can’t fully understand or appreciate biochemistry without a good foundation in organic chemistry. But it is a grueling, difficult course. I learned that during my fulltime summer in organic chemistry at the U of Denver. But it was worth it. I wouldn’t trust a physician who did poorly in organic, or in biochemistry, or in basic physics. Physicians have to be good – very good. We do not want medical schools filled with simply those who *want* to be doctors – they have to have the skills – and the *brains* – to be excellent doctors – all of them. I wanted to be a cool, really good trumpet player. Didn’t happen. Couldn’t happen. Just ask Barb about my musical skills. Competence requires brains *and* skills.

This case also reminds me of my goal to become a great physicist. – and my freshman year at Berkeley (Chapter 2). My score on that first physics exam was 34, I think. The class average was 33.5. I did well, but that was the first and last time I did ‘well’. Remember, the prof said:

‘Many of you will fail, most of you will never become physicists.

This class is really for the few of you with the brains to go all the way.’

I changed majors!

Remember my discussion of Noel de Nevers and the uu Faculty Senate back in Chapter 5 – on inverse grade correlations and grade inflation?

The now-fired NYU prof., Maitland Jones, Jr. said:

‘... the students not only did not study, they did not seem to know how to study.’

Admittedly, this was right after the COVID-19 epidemic, but clearly the other students in the class apparently did know how to study.

We really don’t want C- gradpoint students becoming president, ala George W Bush – and we certainly don’t want our physicians to not know organic chemistry – or physics. Meritocracy does have its good points – as long as all are given the chance to succeed. Many won’t – and perhaps shouldn’t.

This also says a lot about spineless administrators.

## Oct. 7, 2022: Wake-Up Call

Barb went hiking with Fanny and Miriam yesterday – to the lovely willow pond area just above Silver Fork Lodge in Big Cottonwood Canyon. It’s a beautiful spot with a large beaver pond, often a moose, and incredible fall colors. The trail to the pond is perhaps a mile and a half, but quite steep at the beginning and for most of its length – at about 8,000 feet elevation. We haven’t been hiking at altitude for a long time due to my somewhat cumbersome trekking pole requirements, but especially due to Barb’s ongoing COPD. She does OK normally up to 6,000 to 7,000 feet. But Fanny said the colors were beautiful, the weather was perfect, Miriam would be with them – and off they went.

We received a ‘wake-up call’. Before reaching the pond Barb felt very light-headed and somewhat nauseous. Fanny said she looked sleepy. Barb sat down. She had a can of portable oxygen with her and took several whiffs, which may have helped. They made it down to the car and back home without incident.

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Fanny and Miriam were very concerned, thinking they might have to carry Barb down the steep trail. Barb made it out on her own.

Barb often has to slow down and breathe to capture more oxygen when we do walks with significant slopes, even at sea level. But she never has felt nauseous or passed out.

When I got home from ‘work’ (this memoir) at uu, Fanny and Barb were outside chatting and eating. They told me what had happened. We all started to diagnosis the situation and are indeed treating it as a wake-up call. She’ll be 81 in January. COPD is a serious condition, and high elevation activity must be done cautiously. I’m also strongly advising more sugar – it’s brain food! – before and during all strenuous activity. A good excuse to consume chocolate granola bars!

# Oct. 17, 2022: Overlooked No More – MBTI and Visual Values

The NYT this morning included Myers and Briggs in their Overlooked Obituary series. The mother/daughter team died in 1968 and 1980. They developed the widely used Myers-Briggs Type Indicator (MBTI) for assessing the factors involved in an individual’s personality, based on common sense and on their study of Carl Jung’s work. The general goal was to use an individual’s talents and traits to match the requirements of a particular job or function – to fit the worker to the job. This was in the early days of WWII when worker quality and productivity were of immediate and great concern. Myers said she

‘hoped the indicator could help prevent another Hitler by giving as many people as possible a greater understanding and respect for individual differences.’

By 2006 I became aware of the work and began studying it for my own interests in categorizing and understanding people. This interest surely began



when I was Dean, having then developed my own personality summary: there are four 'types' of faculty:

Non-complainers – make do and do good;

Mild-complainers – do your best, request more, complain mildly;

Strong-complainers – do less, request much more, complain loudly and often;

Spoiled, entitled, brats – constant complainers, make excuses, blame all but themselves, challenge and threaten.

I tended to ignore the first and last on the list!

I also realized that as Dean I'd made some serious errors in the selection and appointment of several department chairs. So I began to study personalities, psychology, and 'human nature'.

It was many years later that I finally applied those interests to the Visual Values Project (vvp) – a precursor to my active political interests. I worked with Jake Hanson, Hugh Bollinger, Kay Denton, Steve McQuinn, and a student intern, Brad Buccambuso. We studied the work of Rokeach, Inglehart, Schwartz, and of course Briggs and Meyers. After considerable study from 2011–2012, we selected twelve 'personality' traits and qualities, which we called 'Values' or 'Factors', and developed a metric to estimate such for public figures. We then plotted those estimates ('data') on twelve axes Radar or Star or Rose plots for display, analysis, and comparison. We experimented with the placement of the axes so as to facilitate the emergence of characteristic, identifiable patterns.

Starting at the 'North Pole' of the plot, and going clockwise, the factors are:

Wisdom – Judgment, Courage, Experience, Balance, Decision-making;

Integrity – Honesty, Trust, Truthfulness;

Energy – Ambition, Conscientiousness, Self-direction, Persistence, Tireless;

Inspiration – Open, Communicator, Charismatic, Friendly, Empowering,

Cooperative;

Fearful – Safety, Low risk, Security, Paranoia;

Conformity – Custom, Social expectation, Religion, Don't 'Rock the Boat';

Arrogance – Poor listener, Opinionated, Unrealistic, Aloof; Materialism –

Pleasure, Hedonism, Narcissism, Materialism;

Power – Dominance, Authoritarian, Must be in control;

Humanism – Social Choice, Justice, Compassion, Equality, Tolerance;

Curiosity – Learning, Education, Creative, Objective, Open;

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Emotional Stability – Reasonableness, Rational, Stable, Balanced, in Control.

Each Value is estimated individually and independently of all others using a 1–9 metric. The ‘data’ are then plotted with the 12 Values arranged clockwise. The 7 Values normally associated with more positive or preferred leaders are in the upper half of the plot, while the 5 often considered more negative are in the lower half.

We used the method to assess and evaluate political candidates and public figures. Examples are at [joeandrade.org](http://joeandrade.org) under Visual Values. In addition to current candidates, we tried to assess well known historical figures as well as current political leaders and personalities.

Our goal was to get the public to use the approach to compare and assess candidates in the 2012 election season. This was a year or so before I decided to Run. We made posters (Values Matter!) of the charts and process, gave talks, exhibited in the SLC Public Library, at Kanab’s Earthfest, and several other venues. We set up a web site ([www.visualvalues.us](http://www.visualvalues.us) – no longer live) with the tools needed, including worksheets. We tried to get the press interested – to no avail.

With all the interest in sophisticated graphics and visualization tools now abundant in the media, one might think that such individual metrics and assessments might be helpful. Values still matter!

Spread the word – and the method.

Although the project never had any significant impact, it was very useful to my own development and education. And then I ran for Congress – Chapter 12.

## Oct. 18, 2022: Thoughts while Flossing

I flossed this morning. I hate to floss, but have to do it every 3–4 days or my gums get sore.

Usually I try to listen to something. Today I didn’t.

I'd begun in the shower this morning to just let random thoughts move in and out, thankful that I do have random, unpredictable thoughts. And many of them are interesting and even useful. I began thinking as to when I'd no longer be thinking so much, and, apparently, decided then and there, to think more, record some of those thoughts here and via Tweeting, even if that means less time to read and 'work' (write!).

Maybe this winter in Monterey, Amalia – and even Tonio! – could appreciate some discussion of significant figures and calculators – basically chapters 3 and 6 in *Science without Walls*. I remember how long it took for me to fully capture and apply those simple concepts.

Then, in thinking a bit about significant figures and electronic calculators, I recalled reverse Polish notation (RPN) used on the very new in 1972 Hewlett-Packard 35 scientific calculator. That was likely due to Amalia's recent physics homework question in which there was an issue with sequence of operations on a conventional scientific calculator. And then I thought of purchasing that 1972 HP-35 for \$394, as I recall, from my first research grant (from the US AEC). The Purchasing Dept. asked me why I just couldn't buy a slide rule for 1/10 the cost. Several months later we purchased a second HP-35 because it was so useful.

The point is that recording some of these semi-random recollections is for me, the ageing writer – not for you the reader. As I, hopefully, live on, and remember things out of context, I can refer to this memoir – sort of an encyclopedia of Joey's former brain – to put these memories in context, to recall the narrative, the story.

I'm always reminded of Tom Stockham's answer when I asked when he first realized his memory was going:

'Because I'm no longer having many creative ideas.'

So I may even begin to look forward to flossing...

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## Oct. 23, 2020: From Werk to Arbeit

‘The work which is not upon us to complete, only to begin’ – Joshua Cohen concludes in his NYT review of *The Oppermanns*, the newly reissued 1933 novel on the rise and entrenchment of Fascism in Germany. Rosen begins his review with the *Talmud* quote attributed to Tarfon. Over time the quote morphed into the free transmission of knowledge, ethical standards, and democratic rationality. Rosen focuses the review on *Werk*. Is it work in the sense of art or mental labor; or is it *Arbeit* – work in the sense of effort or labor – physical work. Both are needed – the aesthetic work of art and the activist work of politics.

Feuchtwanger expected his work not just to be something, but to *do* something: the *Werk* giving rise to *Arbeit*, which can bring about a change.”

Although it didn’t work then – yet – for Feuchtwanger, it did ‘work’, to some extent, for Rachel Carson (*Silent Spring*), Paul Ehrlich (*Population Bomb*), John Steinbeck (*Grapes of Wrath*), George Orwell (1984, *Animal Farm*), Upton Sinclair (*The Jungle*), and Aldous Huxley (*Brave New World, Island*) – and others.

A book to encourage and facilitate *doing* something – that was my goal for *State Change* – and continues to be the goal with *Removal*. I’m sure that was/is Kim Stanley Robinson’s goal as well (*The Ministry for the Future*).

From *Werk* to *Arbeit*... onward...

## Nov. 1, 2022: A New Hip – for Milena

On the way to my lunch sandwich cafe in the Orthopedic Research Center this morning – there was Vlado. He was sitting across from the surgery schedule display, his constant computer on his lap. I recognized him, then he recognized me.

“Sit down,” he said.

We hadn't seen the Hladys for a month or more.

"What's going on?" I asked.

"Milena is #4 on the list," he said, pointing to the monitor.

"She just went into surgery."

"For what?" I asked.

"Artificial hip. She's following your footsteps."

I had no idea she was even suffering from hip issues. I knew there were occasional knee concerns, but ...

Vlado noted she's had hip problems and arthritis for some time. And today was the time for surgery. We talked. Vlado was making arrangements for his retirement, to be effective in mid-2023. We learned in spring, 2023 that they had purchased a home in the island they often visited and talked about – Hvar, on the Adriatic coast, in the town of Stari Grad.

## Nov. 12, 2022: Sylvia, Pollan, Human Transformation Factory (HTF)

Sylvia's 14th birthday today! Barb picked out and sent her her own set of three chef's knives.

She's very fond of cooking and doing a chef apprentice course this term. She's hoping this will become part of her unique personality and self.

Today I continued listening to Michael Pollan read and perform his *How to Change Your Mind*, which I'd skimmed several years ago, shortly after it was published in 2018. There's so much there! – and there are major parts of which I've been unaware. He recounts how Rick Doblin, the founder and force behind MAPS, once sent 1000 or so doses of MDMA to Russian military officials working on arms control negotiations with the Reagan administration!

He carefully recounted earlier experiments with psilocybin on volunteers by Bill Richards and Roland Griffiths of Johns Hopkins – and then did ten plus year followup interviews. The long term effects were so profound that Pollan

has called the lab experiments a ‘human transformation factory’ (HTF). This is exactly what Albert Hofmann and Aldous Huxley had in mind. And it was my thesis and hope for the clandestine delivery of MDMA to rigid, ignorant ideologues – the basic premise and plan for *State Change*.

More good news today – a group called Scientists Rebellion, affiliated with Extinction Rebellion (XR) – blocked regional airports serving private jets to bring attention to their destructive climate impact. If such actions prove to be ineffective, the next step is likely direct aircraft sabotage, as described by KS Robinson in his *Ministry for the Future*. Fear of surviving flying should be an effective heads up – and help minimize ‘spoiled brat’ flights.

## Dec. 13, 2022 – After Putin?

Today I listened to an online discussion via the *Bulletin of the Atomic Scientists*, titled:

What’s next for Russia: Does Putin Matter?

One of the participants was psychoanalyst Charles Strozier. He reminded the other two panelists, and taught me, about the end of Hitler. As Hitler sank deeper into his nihilistic insanity, about six weeks before his suicide, he issued the Nero Decree – the complete destruction of Germany.

Earlier Hitler said to his personal physician:

“I will leave all the men of history behind me. I want to be the greatest, even if the whole German people perishes in the process!”

Strozier asked a very simple question. What if Hitler had an atomic bomb? Would he have used it? The answer appears to me to be obvious – and, as Strozier suggested, directly applicable to Vladimir Putin. Strozier writes:

“Putin has given himself a choice Hitler lacked. He need not accept defeat on the battlefield.”

This is existentially frightening.

The only viable argument for Capital Punishment, in my opinion, is the removal – the neutralization – of those working to destroy humankind and the planet. Hitler would qualify – and now so does Vladimir Putin. Hitler took ten

years to remove six million or more people. Putin could do worse in a matter of minutes.

Putin is now the most obvious and most urgent case for immediate assassination.

*Removal – the Case for Assassinations* is my next semi-novel.

Stay tuned...

## Dec. 30, 2022, more or less

Barb, Aaron, Tonio, and I were slowly walking around Lover's Point in Pacific Grove when I spotted a woman wearing a sweatshirt labeled PORTUGAL, with the flag or coat of arms visible. I inquired, in my halting, primitive, primary school level Portuguese:

*Falas Portugues?* She stopped, looked at me, and said  
'*Sim, Fala!*'

So we started talking, in English. After a few minutes she informed us that Portugal has a process by which the grandchildren of Portuguese citizens can themselves apply for and be granted Portuguese citizenship. I'd never heard of such a process.

I have four Portuguese grandparents. Earlier in the year I'd been scanning the many family documents I inherited from Erma back in 2016. There were birth certificates, marriage licenses, passports, etc., including Grandma Maryana Maciel's birth certificate, written in 'official' Azorean cursive. So we did some homework.

Tonio found the site for a law firm in Lisbon showing a document titled: *Grandparent-Based Portuguese Citizenship*. There it was. I'd be eligible if I could produce the appropriate documents and pass a basic Portuguese language proficiency test – at the A2 level. A2 refers to a European Union standard for language proficiency. A2 means roughly advanced Beginner, or beginning Intermediate.

We talked. We found documents and sites discussing *Portugal as a Backup Plan*, referring to what can we do if the USA continues down the dark rabbit hole

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of racism, white supremacy, ignorance, and barbarism. Tonio and Aaron were very interested, because if I obtained citizenship, then they could piggyback on my bonafides to secure their own, and then the granddaughters, etc. Barb and I talked. Although we were too old to use or perhaps even enjoy Portuguese citizenship, we should do this for the kids – a part of our legacy. So we have committed. That's our new Project for 2023 – get the papers, pass the language test, and apply for citizenship – hoping to succeed before I depart the Planet.

We did more homework – and began to study Portuguese. Aaron and I signed up for the A2 exam to be given later in 2023.

We were coming full circle – from my – then our – fascination with Amalia Rodrigues, Fado, Caldo Verde, Frango, and Natas – to our current recalling of travels to and adventures in Coimbra, Lisboa, the Azores, and Madeira.

Onward...



# Obrigado pela Vida

**I**T'S BEEN A wonderful life – and I hope it continues for many more years. But it is time to consider letting go – to ‘sum up’, as Koestler said;

to provide elder advice, as Suzuki has said;

to try to encourage others to leave this world better than they found it.

Planet Earth will do just fine, with or without Mankind.

There will be new species, perhaps new civilizations.

There may even evolve, perhaps catalyzed by the European Union, a world – a planetary – government.

Perhaps Nations may become like States or Provinces,

pleasantly somewhat subservient to a greater – a planetary – whole.

Perhaps Mankind's ‘fatal flaw’ will be tamed, via education, via rites of passage, via meditation, and via empathy-enhancing drugs and practices.

And then violence and war and killing may be minimized or even eliminated. Perhaps.

Perhaps all individuals may be accepted, nurtured, loved – their talents and ambitions appreciated and valued.

Perhaps it's a good time to do something unthinkable, almost impossible, completely unpredictable but useful, helpful, imaginative, perhaps seminal and of great positive importance.

Perhaps.

I quoted Lionel Shriver in the book's Preface:

‘The temptation is to hang on until it's too late, and the opportunity to exercise agency over the end of your life has passed.’

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Agency – both mental and physical – is still available for me. I have discussed my very tentative wishes and plans with Tonio and Aaron, as well as with Barb.

One problem is that I really love life, so I don't want to end it prematurely. Even if physically limited, but retain sufficient mental willpower and horsepower, I can choose to terminate. The problem is if I begin to lose mental agency – and how to rationally assess that mental loss, that deficiency. I am assuming that there will be some periods of clarity in which I will be aware that I have been unaware – that I need to act in one of the next periods of clarity. That should be possible. I'd want to implement willful departure in a manner which does not overly burden Barb, or Tonio, or Aaron.

Willful departure can be accomplished in many ways. I recall Kolff was a member and supporter of the Hemlock Society. Its mission is carried on today by Exit International and related groups.

There are easy, painless, and non-destructive means to terminate one's life – and perhaps donate one's intact body to the utu Body Donor Program.

But it's also an opportunity to experience something very different, unique, life-changing!

Perhaps a parachute jump without opening the chute. Perhaps a ride on a balloon which never stops rising.

I've thought a bit about just walking into the wilderness, with biodegradable trekking sticks, with minimal clothes, no provisions, no phone, no equipment – just water, CBD, THC, and lots of Tylenol to enable me to get into the wilderness so deeply that my remains would likely not be found for years or decades. I plan to pack a small water bottle of strong opium tea to alleviate any serious pain such a last and long trek might require.

More planetarily pragmatic would be to use my death as a way to do something very significant, very meaningful, very beneficial for the Planet. Doug Peacock, a close friend and accomplice of Edward Abbey, has written:

'...why not do something wonderfully bold, courageous, or reckless – like taking out the dictator, executioner, or Nazi of your choosing.'

Perhaps Putin?! There are many individuals who 'merit' taking out.

If my body is readily available, it should go to the utu Body Donor Program, as per my bequeathal request of 8-1-2023.

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I ask Barb, Tonio, and/or Aaron to implement a strong Conservation Easement on our property at 949 Millcreek Way, north of Mill Creek. I would appreciate a small plaque nearby, saying something like:

Joe Andrade (1941 – ??) lived here from 1967 to ???

*Obrigado pela vida – Gracias a la Vida.*

I've enjoyed the ride.

Please enjoy and do good with yours.

For more see: [joeandrade.org](http://joeandrade.org)

Goodbye...

Mill Creek, Utah

9-1-2023



# Appendix: Abbreviations

## *Mini-Words Alert:*

I often use mini- or shortened words in the text where their meaning and understanding are obvious:

rep for representative,

obit for obituary,

prof for professor,

chem for chemistry,

math for mathematics, etc.

4M Lab: Lab for the Modeling, Measurement, and Management of the Metabolome

6 County: SCAOG

9-11: Sept. 11, 2001 Terrorist attack on the WTC Twin Towers in NYC

AAA: American Automobile Association

AAAS: American Association for the Advancement of Science

AAM: American Association of Museums

AAMI: American Association for Medical Instrumentation Ab:  
Antibody

ACS: American Chemical Society

AEC: Atomic Energy Commission

AF: Air Force

AFM: Atomic Force Microscopy

Ag: Antigen

AIMBE: American Institute for Medical and Biological Engineering

ANSC: Australian National Science Centre, Questacon

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ARUP:	Associated Regional University Pathologists
ASA:	American Standards Association rating of film speed
ASAI0:	Aerican Society for Artificial Internal Organs
ASEE:	Amrtican Society for Engineering Education
ASI:	Advanced Study Institute
ASM:	American Society for Museums
ASME:	American Association of Mechanical Engineers
ASTC:	Association of Science and Technology Centers
ATP:	Adenosine triphosphate
ATR:	Attenuated Total Reflection
BandW:	Black and White
BCCP:	Biotin Carboxyl Carrier Protein
BECON:	Bioengineering Consortium
BFST:	Blood Flow Stimulation Therapy
BLM:	Bureau of Land Management
BME:	BioMedical Engineering
BMES:	BioMedical Engineering Society
BMI:	Blood-Materials Interactions
BMI:	Battelle Memorial Institute
BMI:	Biomaterials International, Inc.
BPPV:	benign paroxysmal positional vertigo
BPRB:	BioPolymers Research Building
BRAC:	Blue Ribbon Advisory Committee (Climate Change)
BRAC:	Base Realignment and Closure (military bases)
BW:	BodyWorlds
BYU:	Brigham Young University
CAAC:	People's Aviation Company of China, but often China Air Always Cancels
CandEN:	<i>Chemical and Engineering News</i> , published by ACS
CAT:	Clinical Advisory Team
CBD:	Cannabidiol
CBI:	Center for Biopolymers at Interfaces
CC:	Current Contents
CCCC:	Collection of Czechoslovak Chemical Communications
CGCD:	Center for Controlled Chemical Delivery

## Appendix: Abbreviations

CCD:	Charge-Coupled Device
CCL:	Citizens Climate Lobby
CDA:	Center for Documentary Arts
CDC:	Centers for Disease Control
CEDIA:	Cloned Enzyme Donor Immunoassay
CEO:	Chief Executive Officer
CES:	Closed EcoSystems
CHOMPS:	Community Hospital of the Monterey Peninsula
CIA:	Central Intelligence Agency
CISE:	Center for Integrated Science Education
CLEAR:	Concerned about Limited Energy and Air Resources
CNRS:	Centre national de la recherche scientifique
CO:	Carbon monoxide
CO <sub>2</sub> :	Carbon dioxide
COPASI:	complex pathway simulator program
COPD:	Chronic Obstructive Pulmonary Disease
COSI:	Center of Science and Industry, Columbus, Ohio
COSMAT:	Committee on the Survey of Materials Science and Engineering
CPA:	Certified Public Accountant
CPR:	Cardiopulmonary Resuscitation
CRHCT:	Cost-Reducing Health Care Technologies
CSC:	California Science Center (csc) in Los Angeles
CSM:	College of San Mateo
CSME:	Center for Science and Math Education
CU:	University of Colorado
CVRTI:	CU Cardiovascular Research and Training Institute
DARPA:	Defense Advanced Research Projects Agency
DC:	Washington, D.C.
DEC:	Digital Equipment Corporation
DFCM:	Division of Facilities Construction and Management
DOE:	Department of Energy
DOW:	Discovery on Wheels
DRI:	Denver Research Institute
DU:	Denver University (U of Denver)
EandM:	Electricity and Magnetism

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EBM:	Espresso Book Machine
EKG:	Electrocardiogram
ECSITE:	European Collaborative for Science, Industry, and Technology Exhibitions; European Network of Science Centres and Museums
EDTA:	European Dialysis and Transplant Association
EE:	Electrical Engineering
EEG:	Electroencephalogram
EMCB:	Engineering and Mines Classroom Building
EMG:	Electromyogram
EPA:	Environmental Protection Agency
ER:	Emergency Room
ERC:	Engineering Research Center
ESCA:	Electron Spectroscopy for Chemical Applications
FAA:	Federal Aviation Agency
FBR:	Foreign Body Reaction
FDA:	Federal Drug Administration
FDR:	Franklin Delano Roosevelt
FF:	Frequent Flyer
FFKR:	SLC architectural firm
FIPSE:	Fund for the Improvement of Postsecondary Education
FLIR:	Forward-Looking InfraRed
FMN:	Flavin mononucleotide
FSF:	Fueling Sustainable Futures
GALT:	Galactose-1-phosphate uridylyltransferase
GB:	Gigabyte
GBNP:	Great Basin National Park
GBWN:	Great Basin Water Network
GDD:	Gravity-Deficit Disorder
G-I:	Gastrointestinal
GIS:	Geographic Information Systems
GSC:	Glasgow Science Centre
GENM:	Grand Staircase-Escalante National Monument
GSR:	galvanic skin response
HB:	House Bill
HEMA:	Hydroxyethyl methacrylate



## Appendix: Abbreviations

HEPA:	High Efficiency Particulate Air (Filter)
HETI:	Higher Education Technology Initiative
HHMI:	Howard Hughes Medical Institute
HJR 12 and 21:	House Joint Resolution, Utah
HP:	Hewlett-Packard
HP:	Hansen Planetarium
HQ:	Library of Congress Classification – Family, Marriage, Women
HTF:	Human Transformation Factory – via Michael Pollan
HUAC:	House Unamerican Activities Committee
IandS:	Igor and Shirley
IASP:	International Association for the Study of Pain
ICMBE:	International Conference on Medical and Biological Engineering
ICP-MS:	Inductively-coupled Plasma Mass Spectrometry
IEEE:	Institute of Electrical and Electronic Engineers
IHC:	Intermountain Health Care
IMC:	Institute for Macromolecular Chemistry, Prague
INSERM:	Institut National de la Santé et de la Recherche Médicale (French Institute of Health and Medical Research)
IOM:	Institute of Medicine
IPCC:	Intergovernmental Panel on Climate Change
IPP:	Intermountain Power Project
IQ:	Intellectual Quotient
IRS:	Internal Revenue Service
ISBC:	International Society for Bio- and Chemi-luminescence
ISEE:	Informal Science Education Enhancement
ISI:	Institute for Scientific Information
ISS:	Ion Scattering Spectroscopy
IUPAC:	International Union of Pure and Applied Chemistry
JBMR:	<i>Journal of Biomaterials Research</i>
KAIS:	Korean Advanced Institute of Science
KIST:	Korean Institute of Science and Technology
KAL:	Korean Air Lines
KOSEF:	Korean National Science Foundation
KRICT:	Korea Research Institute for Chemical Technology

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KRIST:	Korea Research Institute of Science and Technology
LA:	Los Angeles
LAX:	LA International Airport
LDS:	Latter Day Saints – Mormons
LEED:	Leadership in Energy and Environmental Design
Leo:	Leonardo da Vinci and/or The Leonardo
LG:	Life's Good brand
LLC:	Limited liability company
LLL:	Lawrence Livermore Laboratory
LOW:	Leonardo on Wheels
LTIC:	low temperature isotropic carbon
LV:	Las Vegas
LWV:	League of Women Voters
MA:	Masters of Arts
MAPS:	The Multidisciplinary Association for Psychedelic Studies
MARTA:	Atlanta area light rail system
MBA:	Masters of Business Administration
MBTI:	Myers-Briggs Type Indicator
MBWA:	Management By Wandering Around
MDD:	Motion Deficit Disorder
MDMA:	3,4-Methylenedioxy methamphetamine , not a psychedelic.
ME:	Mechanical Engineering
MEB:	Merrill Engineering Building, uu
MESA:	Mormon Environmental Stewardship Alliance
MESA:	Mormon Environmental Stewardship Alliance
MIT:	Massachusetts Institute of Technology
MITI:	Ministry of International Trade and Industry (Japan)
MM:	Maryana Maciel
MOMA:	Museum of Modern Art
MRI:	Magnetic Resonance Imaging
MSE:	Materials Science and Engineering
MTA:	Metropolitan Transit Authority, Boston
MV:	Mill Valley
NAB:	National Advisory Board
NADH:	Nicotinamide adenine dinucleotide

## Appendix: Abbreviations

NAE:	National Academy of Engineering
NAS:	National Academy of Sciences
NASA:	National Aeronautics and Space Administration
NCRR:	National Center for Research Resources
NDA:	Non-Disclosure Agreement
NE:	Northeast
NESAC:	National ESCA and Surface Analysis Center.
NIAMD:	National Institute of Arthritis and Metabolic Diseases
NIBIB:	National Institute of Biomedical Imaging and Bioengineering
NICHD:	National Institute of Child Health and Development
NIH:	National Institutes of Health
NHLBI:	National Heart and Blood Institute
NIT:	Nanjing Institute of Technology
NRDC:	Natural Resources Defense Council,
NSAID:	NonSteroidal Anti-Inflammatory Drugs
NSF:	National Science Foundation
NW:	Northwest
NYAS:	New York Academy of Sciences
NYC:	New York City
NYT:	New York Times
NYU:	New York University
OC:	Open Classroom
OMSI:	Oregon Museum of Science and Industry
ONR:	Office of Naval Research
ORC:	Orthopedic Research Center
OSU:	Oregon State University
OTA:	Office of Technology Assessment
PBS:	Public Broadcasting System
PC:	Politically correct
PCV:	Peace Corps Volunteer
PEG:	Polyethylene glycol (also PEO)
PEO:	Polyethylene oxide
PEU:	Poly ether Urethanes
PG:	Pacific Grove
PHEMA:	PolyHEMA

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PI:	Principal Investigator
PILT:	Payments in Lieu of Taxes, a Federal program
PKU:	Phenylketonuria
POLST:	Physician Orders for Life-Sustaining Treatments
PPG:	Program Project Grant
PR:	Public Relations
PSC:	Public Service Commission
PSI:	Protein Solutions, Inc.
PT:	Physical Therapy/Therapist
PTSD:	Post-Traumatic Stress Disorder
QandA:	Questions and Answers
QM:	Quantum Mechanics
QM:	Library of Congress Classification – Human Anatomy
QP:	Library of Congress Classification – Physiology
RandD:	Research and Development
RBR:	Reserve Book Room
RC:	Rockwell Collins
RDT:	Reperatory Dance Theatre
RFGD:	Radio frequency glow discharge
RFP:	Request for Proposals
RLS:	Restless Leg Syndrome
ROTC:	Reserve Officer Training Course
RPN:	Reverse Polish Notation
RPT:	Retention, Promotion, Tenure
RV:	Recreational Vehicle
SAC:	Scientific Advisory Committee
SAP:	Scientific Advisory Panel
S&N:	Smith and Nephew
SB:	Senate Bill
SBIR:	Small Business Innovation Research
SCAOG:	Six County Association of Governments
SCI:	Scientific Computing Institute
SCS:	Simplicity to Complexity to Simplicity
SE:	Southeast
SEM:	Scanning Electron Microscope

## Appendix: Abbreviations

SERS:	Surface Enhanced Raman spectroscopy
SF:	San Francisco
SFM:	Scanning Force Microscopy
SFO:	San Francisco Airport
SIMS:	Secondary Ion Mass Spectrometry
SJSC, SJSU:	San Jose State College, University
SLC:	Salt Lake City
SLCC:	St. Louis Science Center
SLCC:	Salt Lake Community College
SLCPL:	Salt Lake City Public Library
SLCSE:	Salt Lake Center for Science Education
SLR:	Single Lens Reflex camera
SLVSEF:	Salt Lake Valley Science and Engineering Fair
SMM:	Science Museum of Minnesota
SMU:	Southern Mississippi University
SRA:	Society for Risk Analysis
SRI:	Stanford Research Institute
STEAM:	Science, Technology, Engineering, Arts, Math
STEM:	Science, Technology, Engineering, Math
STM:	Scanning Tunneling Microscopy
STTR:	Small Business Technology Transfer Research
STS:	Slow Thinking Syndrome
SUNY:	State University of New York
SUTREC:	Southwest Utah Renewable Energy Center,
SUU:	Southern Utah University
SW:	Southwest
SWOW:	<i>Science without Walls</i> educational TV series
TAD:	Tooele Army Depot
TAMS:	Teaching Aids for Macromolecular Structure
TandJ:	Tom and Judy
TCMU:	The Children's Museum of Utah
TDP:	Tau Delta Phi – sjsc honor society
TESOL:	Teaching English as a Second Language
TFTM:	Too Far to Measure – Parachutists phrase

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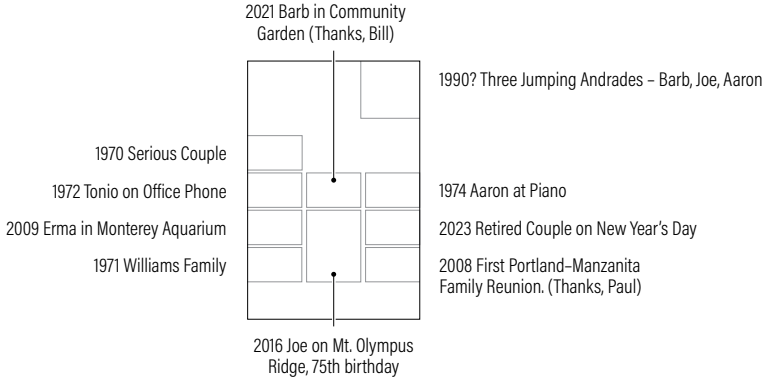
TIAA-CREF:	Teachers Insurance and Annuity Association of America College Retirement Equities Fund
TFFTM:	TFTM with a color adjective
THC:	Tetrahydrocannabinol
TI:	Texas International Airlines
TIRF:	Total Internal Reflection Fluorescence
TLC:	Tender, loving care
TLC:	Thin layer chromatography
TRAX:	Salt Lake City light rail system
TSS:	Two by Six Problem or Syndrome
U:	University
UBC:	University of British Columbia
UC:	University of California
UCLA:	University of California at Los Angeles
UCSB:	uc-Santa Barbara
UCSC:	uc-Santa Cruz
UCSD:	University of California, San Diego
UCTM:	Utah Council of Teachers of Mathematics
UG:	Undergraduate
UMFA:	Utah Museum of Fine Arts
UMNH:	Utah Museum of Natural History
UN:	United Nations
UNSS:	Utah Nature Study Society
UO:	University of Oregon
UPL:	Utah Power and Light
USC:	University of Southern Calif
USC:	Utah Science Center
USCA:	Utah Science Center Authority
USCF:	Utah Science Center Foundation
USOE:	Utah State Office of Education
USPO:	United States Post Office (Postal Service)
USTA:	Utah Science Teachers' Association
USU:	Utah State University
Utah	
CLEAR:	Concerned about Limited Energy and Air Resources

## Appendix: Abbreviations

UTI:	Urinary Tract Infection
UU:	University of Utah
UURI:	University of Utah Research Institute
UV:	Ultraviolet
UW:	U of Washington
VA:	Veterans' Administration
VCBO:	Salt Lake City architectural firm
VOR:	Very-high Frequency Omni Range aircraft navigation system
VP:	Vice Presidency
VVP:	Visual Values Project
VW:	Volkswagen
WAS:	Whitaker Alumni Society
WGU:	Western Governors' University
WHO:	World Health Organization
WIRED:	Workforce Innovation in Regional Economic Development
WSU:	Weber State University
WTC:	World Trade Center
WUHS:	Washington Union High School
WVD:	World Vasectomy Day
WWII:	World War II
XPS:	X-Ray Photoelectron Spectroscopy
XR:	Extinction Rebellion
Y2K:	The Millennium Transition
YWCA:	Young Women's Christian Association

# Photo captions:

## FRONT COVER:



## BACK COVER:

### Column 1:

1965 Joe's Parachute, Hollister  
 1985 The Three Children:  
 Nina, Tonio, Aaron  
 1988 De Gennes and Son at Cecret Lake  
 1987 Milena and Barb Dancing  
 2010 Sissy, Malek, Carol, Shaphar, Barb  
 2015 Tonio, Andrea, Josie, Sylvia,  
 Amalia - Cape Falcon OR.  
 1980 Arsalans: Ahmad, Mary,  
 Humaira, Mariam, Frozan, Shafiqa

### Column 2:

1966 Perdido Resting, Denver  
 1986 Koreans and Other Collaborators  
 1996 Barb and Mr. Dove  
 2000 Kolff, Elaine, Barb - Listening  
 2011 Miriam and Blauers: Fanny,  
 David, Juliette, Danny  
 2023 Latinas Recognizing Barb

### Column 3:

1968 Guitaras Andrades, Denver  
 1987 The Pond on Highland Drive  
 1990 Yanke and Willem Kolff, Barb, Joe  
 2009 Hladys, Kopeceks, Creekside  
 2011 Barb, Shaphar, Elaine,  
 Milena, Francoise  
 2018 Family Hibbs at Creekside  
 1985 Smiles - Jacqueline and  
 Marcel Jozefowicz, Barb





